The theory and pedagogy of semantic inconsistency in critical reasoning

by

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submitted in accordance with the requirements
for the degree of

DOCTOR OF PHILOSOPHY

AT THE

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROFESSOR C D SCOTT

MAY 2018

Declaration

I declare that “THE THEORY AND PEDAGOGY OF SEMANTIC INCONSISTENCY IN CRITICAL REASONING” is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software. The result summary is attached.

I further declare that I have not previously submitted this work, or part of it, for examination at UNISA for another qualification or at any other higher education institution.

4/5/2018

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Abstract (English)

One aspect of critical reasoning is the analysis and appraisal of claims and arguments. A typical problem, when analysing and appraising arguments, is inconsistent statements. Although several inconsistencies may have deleterious effects on rationality and action, not all of them do. As educators, we also have an obligation to teach this evaluation in a way that does justice to our normal reasoning practices and judgements of inconsistency. Thus, there is a need to determine the acceptable inconsistencies from those that are not, and to impart that information to students.

We might ask: *What is the best concept of inconsistency for critical reasoning and pedagogy?* While the answer might appear obvious to some, the history of philosophy shows that there are many concepts of “inconsistency”, the most common of which comes from classical logic and its reliance on opposing truth-values. The current exemplar of this is the standard truth functional account from propositional logic. Initially, this conception is shown to be problematic, practically, conceptually and pedagogically speaking. Especially challenging from the classical perspective are the concepts of *ex contradictione quodlibet* and *ex falso quodlibet*. The concepts may poison the well against any notion of inconsistency, which is not something that should be done unreflectively. Ultimately, the classical account of inconsistency is rejected.

In its place, a semantic conception of inconsistency is argued for and demonstrated to handle natural reasoning cases effectively. This novel conception utilises the conceptual antonym theory to explain semantic contrast and gradation, even in the absence of non-canonical antonym pairs. The semantic conception of inconsistency also fits with an interrogative argument model that exploits inconsistency to display semantic contrast in reasons and conclusions. A method for determining substantive inconsistencies follows from this argument model in a straightforward manner. The conceptual fit is then incorporated into the pedagogy of critical reasoning, resulting in a natural approach to reasoning which students can apply to practical matters of everyday life, which include inconsistency. Thus, the best conception of inconsistency for critical reasoning and its pedagogy is the semantic, not the classical.

KEYWORDS

Inconsistency, propositional logic, critical reasoning, semantic, antonymic, pedagogy, defeasible, translation

Abstract (isiZulu)

Ingqikithi Yocwaningo mayelana nalokhu: **Inzulumcabango nemfundiso yencasiselo yamazwi eshintshashintshayo ekucabangeni ngokujulile.**

Enye yezinhlangothi zokucabanga ngokujulile ngukuhlaziywa nokubekwa kwenani ngokwesilinganiso kokushiwoyo nakulokho okuqophiswna ngako. Inkinga evamile ekuhlaziyeni nasekubekeni inani kokuqophiswana ngakho ngeyezitatimende ezishintshashintshayo. Lokhu kushintshashintsha kungaba nemiphumela emibi ekusetshenzisweni kwengqondo nasekwenziweni kwezinto. Nakuba kunjalo, akusikona konke ukushintshashintsha okunaleyo miphumela. Njengoba singothisha, sinesibopho sokufundisa lokhu kuhluza ngendlela eyenza ubulungiswa ekucabangeni kwethu ngokwenjwayelo kanye nasekwehlulelenі maqondana nokushintshashintsha. Ngenxa yalokho, kunesidingo sokwehlukanisa ukushintshashintsha okwamukelekile kulokho okungemukelekile, nokudlulisela lolo lwazi kubafundi.

Singabuza ukuthi, y*iwona muphi umqondongqangi ongcono kunayo yonke kuleyo emayelana nokushintshashintshayo maqondana nokucabanga ngokujulile kanye nemfundiso*? Yize impendulo yalo mbuzo ingavela njengesobala kwabanye, umlando wefilosofi uveza ukuthi miningi imicabangongqangi emayelana “nokushintshashintsha”. Eyimvama kakhulu iqhamuka emqondweni wokucabanga okuhlelekile okungashayisani kanye nokuncika kwayo ekuphikisaneni nemigomo yeqiniso. Isibonelo samanje salokhu yiqiniso elaziwayo lokubili okungamaqiniso okungashayisani okusukela kwizitatimende eziveza ukwahlulela noma imibono. Ngasekuqaleni, le micabango ivezwa njengento eyinkinga maqondana nokwenza, nemiqondongqangi nemfundiso. Oluyinkinga kakhulu ngokombono onqala yimicabangongqangi yemigomo yokuphikisana nokungabi nabuqiniso (*ex contradictione quodlibet* and *ex falso quodlibet)*. Le miqondongqangi ingamosha yonke imiqondongqangi ekhona maqondana

nokushintshashintsha, nokungasiyo into okumele yenziwe ngokungacabangisisi. Ekugcineni, uhlobo lwencazelo yakudala yokushintshashintsha alwamukeleki.

Esikhundleni sencazelo yakudala, ukuba khona kwencasiselo yamagama adala ukushintshashintsha kuyaqophiswana ngakho kuphinde kuvezwe njengokukwazi ukubhekana nezimo zokucabanga ngokwemvelo ngendlela enempumelelo. Le micabango emisha isebenzisa inzulumcabango ephikisa kabusha incazelo yokwahluka kwencasiselo yamagama nokuhleleka ngokulandelana kobukhulu, ngisho ngabe kuthiwa okunye kwangaphandle okuhambisana nokunye okuphikisana nakho akukho lapho. Ukwakhiwa kwencasiselo yamagama ashayisanayo kuphinde kungene kuthi khaxa ohlobeni lokuphikisana okusakuphenya okuhlolisisa ukushintshashintsha ukuze kuvezwe ukwahluka kwencasiselo yamagama ezizathwini ezibekiwe naseziphethweni. Indlela yokubona ukushintshashintsha okunqala ilandela lolu hlobo lodaba ngokuqondile. Ukungena khaxa komqondongqangi kube sekuhlanganiswa nemfundiso yokucabanga ngokujulile nokufinyelela endleleni eyimvelo yokucabanga kubafundi maqondana nezindaba ezenzekayo empilweni yansuku zonke, nokufaka kukho ukushintshashintsha. Ngakho-ke, okuyiwona mqondongqangi omuhle kunayo yonke yokushintshashintsha maqondana nokucabanga ngokujulile kanye nemfundiso yakhona ngukuba khona kwencasiselo yamagama adala ukushintshashintsha kunaleyo yakudala.

Abstract (seSotho)

Teore le mokgwa wa thuto wa ho se dumellane ha moelelo ka ho beha mabaka a bohlokwa

Karolo e nngwe ya mabaka a bohlokwa ke ho hlahloba dingangisano, dipolelo le mabaka. Bothata bo tlwaelehileng, mabapi le ho hlahloba le ho qaqisa dikgang, ke dipolelo tse sa dumellaneng. Le hoja ho se dumellane ho mmalwa ho ka nna ha eba le diphello tse mpe hodima ho nahana le pethahatso ya ketso, ha se kaofela ha tsona di leng jwalo. Jwaloka barupelli, re boetse re na le boikarabelo ba ho ruta tlhahlobo ena ka tsela e etsang toka ho mekgwa ya rona ya ho nahana le kahlolo ya ho se dumellane. Kahoo ho teng tlhokahalo ya ho kgetholla ho se dumellane ho amohelehang ho batho bao e seng, le ho fana ka lesedi leo baithuting.

Re ka botsa: Ke lereo lefe le molemo ka ho fetisisa le sa dumellaneng tabeng ya ho beha mabaka le ho ruta? Le hoja karabo e ka nna ya bonahala e hlakile ho ba bang, histori ya filosofi e bontsha hore ho na le mareo a mangata a "ho se dumellane", a tlwaelehileng ka ho fetisisa a hlahang mokgweng wa motlolo wa kgale o itshetlehileng hodima ho ba kgahlano le metheo ya dinnete tse hanyetsanang. Sepheo sa moraorao sa sena ke akhaonto e sebetsang hantle ya nnete ho tloha molaong wa tlhahiso-taba. Qalong, monahano ona o bontsha hore o na le bothata, mme ha e le hantle, o na le maikutlo a ho nahana le a ho ruta. Ntho e thata ka ho qolleha ho latela maikutlo a motlolo wa kgale ke mareo a *ex contradictione quodlibet le ex falso quodlibet*. Mareo ana a ka nna a silafatsa maikutlo kgahlanong le maikutlo leha e le afe kapa afe a ho se lumellane, e seng ntho e lokelang ho etswa ka mokgwa o sa lokelang. Qetellong, tlaleho ea motlolo wa kgale ya ho se dumellane e qhelelwa thoko.

Sebakeng sa yona, moqapi wa moelelo wa ho se dumellane o phehisana le ho bontshwa ho sebetsana ka katleho ya dinyewe tsa ho nahana ka tlhaho. Lereo lena la bohlokwa le sebedisa teore ya mahanyetsi ho hlalosa hlalosa phapang ya moelelo le ho khetholla, esita le ho ba siyo ha dipara tse hanyetsananang. Moelelo wa lereo la ho se dumellane o boetse o dumellana le mokgwa wa dipuisano wa dipotso o senyang ho se lumellane ho bontshang phapano ya moelelo ka mabaka le diqeto. Mokgwa wa ho kgetholla ho se dumellane ho ka sehloohong o tla ho latela mokgwa ona wa papiso ka tsela e tobileng. Mokgwa o nepahetseng o kenyelletswa ka mokgwa o tshwanang wa ho beha mabaka, ho fella ka mokgwa wa tlhaho wa ho beha mabaka ao baithuti ba ka a sebedisang dinthong tse sebetsang tsa bophelo ba letsatsi le letsatsi, tse kenyelletsang ho se dumellane. Ka hona, maikutlo a mabeli a ho se dumellane ha mabaka a tebileng le mokgwa wa ona wa ho ruta ke moelelo, eseng motlolo wa kgale.

Curriculum Vitae

My father came to California as a sharecropper. He worked the fields of the Coachella Valley picking cotton. Eventually, he made his way to Los Angeles, where he found work in a petrol station. During this time, he met my mother, a California native, who was in school to be a teacher. My father eventually owned that petrol station and started a life making our family. He had the equivalent of a 7th grade education, yet he instilled in his children a love of learning, as did my mother. My mother taught first grade for close to 30 years. It was her love of teaching that became infectious for me later in life.

I was not a good student in my primary education, and it was not until I returned to school at 28 years old that I took it seriously. I initially earned a BA in Philosophy and then an MA in Philosophy. During this time my love of logic and reasoning blossomed, but so did my desire to teach. Eventually, after teaching at a few schools, I found a tenure-track job at my current school, Rio Hondo College in Whittier California. My school is a two-year school that serves a diverse population in terms of both background and educational preparation. My students motivate me daily to be the best instructor I can be.

My primary areas of interest and teaching are informal reasoning and formal reasoning. I am especially passionate about inconsistency in reasoning and everyday life. However, my main interest in life is my family, especially my wife. She is a math teacher who came to the U.S.A. from Mexico as a young child, with all the struggles of an immigrant in a foreign land. I see her strength and resolve daily but I also see my students in her with their struggles. My wife motivates me to be the best person I can be, and for that, I am most thankful.

Acknowledgements

Over 30 years ago I began a journey in philosophy with the hopes of one day obtaining a doctoral degree. This thesis culminates a life's work. No man is an island unto himself, thus, many were involved in this project over the years. I could not possibly list them all but I thank them nonetheless. I am especially grateful to the following people:

1) My wife Monica who has been a constant source of support and love. Her daily strength and smile always move me forward. It is because of her that I continued in dark times and now have finally seen the light. *Te amo mucho mi Cheeto!*

2) My adviser Professor Callum Scott whose patience, knowledge, and care made this work better. Thank you for taking on a project that flies in the face of much of the critical reasoning literature and place of formal logic in reasoning altogether. You are the *exemplar* as an adviser; a role model for your students *par excellence.*

3) My friend and colleague Ted Preston who consistently supported me, read too many drafts over 17 years of various work, and makes me a better person daily. He is the *exemplar* of an Aristotelian friend and a gift from God in my life.

4) My cousin Mark Sackman provided more than almost any other person over the years. His patience and kindness kept me employed and able to complete school. Without him, my venture into philosophy would not have been undertaken or completed. Words cannot express my gratitude for him and his family.

5) My undergraduate professors, especially David Adams, Dale Turner, Rafael Rondón (QEPD), Darrel Moellendorf, Laurie Shrage, Judy Miles, and Richard C. Richards. Their constant support over the years made me believe in myself.

Professor Richards, of all, taught me Hume's famous *credo* about still being a man amidst all your philosophy. His sage advice and honesty will always remain with me. *It is to him, Richard C. Richards, that I dedicate this thesis.*

6) To my mother Joan Dixon, my grandmother Bessie Sackman, Chris Janusz, Paul Stratakis, and Wesley Silveria. You all left long before your time. But, your support and love are still with me today.

7) To my family in Mexico who took care of me during long stretches of writing, you share in this project as well. I especially want to thank Ricardo Tirado, Viviana Tirado, *Tia* Conchita Tirado, and *Tia* Carmen Tirado. *Mucho abrazos!*

8) My colleagues at Rio Hondo College provided commentary and support for many years. I want to thank Rebecca Green, Hector Gonzaléz, Brian Brutlag, Kevin Smith, Steve Hebert, Mike Slavich, Kathy Pudelko, Rene Tai, Elizabeth Chavez, Sue Bernache, Phildon Huffaker, Mark Deering, and Kevin Barman.

9) Finally, I would like to thank the people of South Africa and UNISA for their generosity and ability to attend a school across the globe. A person is a person through other people and your gracious nation and university made me whole.

> *"We are ensnared by the Wisdom of the Serpent, we as set free by the Foolishness of God"* (Saint Augustine, *On Christian Doctrine,* 1.14.13).

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Introduction

Background

Since Aristotle's *Organon* (1941:3–212), formal logic has held the honour of upholding the standards of ideal deductive reasoning, and rightly so. Formal deductive logic displays necessary connections between ideas and provides epistemic certainty. In recent times, formal logicians such as Quine (1980, 1986a & 1986b), Quine and Ullian (1978) and Hoyningen-Huene (2004), and formal logic textbook writers – including Hurley (2014) and Gensler (2010) – have cherished the propositional truth functional account of inconsistency as the ideal. Inconsistency in this sense is typically defined as: not all claims in a set are true given instances of conflicting claims.[1]

The propositional truth functional account of inconsistency, as taught, disconnects from our ordinary everyday account of semantic inconsistency: inconsistency based on the conflict of natural language meaning. This "ideal" influence taints critical reasoning theory and pedagogy, where contemporary instructors consider formal logic and critical reasoning as similar or even the same discipline, as indicated by Poston's (2012), May's (2010), Moore's (2012) and Michelfelder's (2011) syllabi for instance.[2]

Yet, in the twentieth century, the informal logic movement started turning away from the "ideal" and started paying attention to what we do when we reason. Groarke writes (2011:§1), "The trends that give rise to informal logic as a unique discipline of study coalesce in North America in the late 1960s." Rarely do we naturally argue in the formal deductive sense where the premises necessarily entail the conclusion; rarely, if ever, do we need to translate arguments in natural

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[1] This is my definition.
[2] Moore (2012) is an interesting example as Moore (and Parker) uses an earlier edition of his *Critical Thinking* text [2012-10th ed.] to teach an introduction to logic and a critical thinking course. The syllabus follows the structure of his book.

language into symbolic form and test them for deductive validity. The practices of the ideal and the practical thus became disconnected. To this end, philosophers in the informal logic movement – including Scriven (1976), Toulmin (1958 & 2003), Groarke (2011), Hamblin (1970) and Johnson (2000) – view formal logic and informal logic as two different disciplines.

Objectives

This thesis comprises six main objectives that roughly correspond to each chapter:

1) to provide a limited relevant history of inconsistency;
2) to accurately represent propositional logic;
3) to accurately critique propositional logic as a system;
4) to use a contemporary antonym theory to make sense of semantic inconsistency judgements in ordinary language and ordinary language arguments;
5) to critique propositional logic as a system of critical reasoning; and
6) to detail the relevance of the new semantic theory of inconsistency to critical reasoning pedagogy.

Research questions

Corresponding to the six objectives, there are six research questions:

1) What does the history of inconsistency demonstrate about the concept?
2) What is a correct representation of propositional logic and propositional logic inconsistency?
3) What are the essential elements of a substantive critique of propositional logic and propositional logic inconsistency?
4) How can a contemporary antonym theory articulate inconsistency judgements in natural language and reasoning?
5) Why does propositional logic fall short as a theory of critical reasoning?

6) What is the best concept of inconsistency for critical reasoning theory and pedagogy?

Aims

To answer the research questions there are several issues that need to be addressed. This will be done through exploring three general aims, each is taken in turn. The first aim is to correct the identified flawed conception showing that critical reasoning in theory and practice is distinct from formal propositional deductive logic as an implicative system of rules. In making this distinction, the propositional truth functional account of inconsistency does not capture our ordinary intuitions, viz. semantic conflict, about inconsistency and should be rejected.

What might be the alternative to this standard propositional account? I propose that a unique account of semantic inconsistency based on the conceptual antonym theory fits with our ordinary reasoning practices. This solution makes use of modern linguistics and rejects the canonical antonym theory which operates in explicit pairs. It also rejects any truth functional account as truth functions come after semantic conflict recognition.

The truth functional account of inconsistency holds a fundamental role in propositional logic and by extension in philosophy. After completing a formal deductive logic course, students have no contrastive inconsistency concept and have reason to believe the truth functional account is the only one. This limited conception, I will argue, may result from a lack of serious consideration of other alternatives such as those that arise from semantic inconsistency judgements in everyday life and our normal practices.

Minimally, the initial chapter of this thesis will reveal a family of inconsistency concepts, not just one. The family of concepts has consequences to the field of philosophy on a whole where the truth functional concept of inconsistency is the standard or regulative concept. Assessment of inconsistency claims could then take on other forms not related to truth-values alone, but to conflicting semantic claims. Recognising semantic conflict requires no exposure to the rules and understanding of formal deductive logic; instead, this recognition relies on our natural ability to understand conflicting semantic content in natural language claims. This acknowledgement occurs before considering the truth-values of the claims. By developing this semantic account with sensitivity, this priority in judgement develops a philosophical conception of semantic inconsistency. This conception reveals when a semantic inconsistency is important or not, all without reference to truth-values, so diverting from the strictures of formal logic.

This different account of inconsistency, a semantic one, has special importance to the pedagogy of critical reasoning wherein I opine that the conceptual lines have been blurred between formal deductive logic and informal logic.[3] The blurring is a case of mistaking implication for inference, where the former is the domain of formal logic and the latter, is the domain of critical reasoning. The semantic conception of inconsistency naturally aligns with natural language arguments and requires no translation into a formal language or knowledge of implications of inconsistency. More so, by exposing contrasting types of systematic inconsistency, a robust understanding of the *whole* concept of inconsistency is presented. This contrastive influence leads to a broader understanding for the discipline of philosophy.

Pedagogically, the propositional truth functional account of inconsistency has halting or stopping effects in normal argument situations. This effect is deleterious to understanding what has gone wrong or why the inconsistency is not substantive. While not immediately clear, the truth functional account guides philosophical practice through inconsistency charges. A different account of inconsistency might well impact this practice in a positive way by providing an alternative to the halting problem through more debate and discussion of the contested concepts.

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[3] I have taught on six campuses, in two different geographical regions for eighteen years. I have also taught at two-year colleges and four-year universities. Almost every colleague used propositional logic and Aristotelian logic in varying degrees in a critical reasoning course, and some even use the same textbook for both critical reasoning and introduction to logic courses.

My next aim is to develop and articulate a natural language account of semantic inconsistency that captures what we do in practice with inconsistency judgements in everyday reasoning. This natural language account rejects the standard propositional truth functional account as limited in scope and not rich enough to articulate the subtleties of our natural language reasoning practices and communicative patterns. The natural language account is largely based on a particular antonym theory that relies on contrast, gradation, context, and semantic knowledge. Due to the contextual emphasis, the value of the semantic inconsistency can be evaluated, where it may be problematic.

By applying a contextual antonym theory to reasoning with semantic inconsistencies, a third aim manifests with a novel account of how to handle semantic inconsistencies for application in critical reasoning courses. Critical reasoning, as such, is just giving and understanding the right contextual reasons, which may or may not involve inconsistencies. Applying this account to pedagogical conventions in critical reasoning demonstrates a more articulate and natural view of inconsistency – a semantic one – that aligns with everyday human reasoning and communicative practices.

Unique contributions of the research

Analysis of this research has enabled me to identify three unique contributions made by this work to the knowledge economy:

1) propositional logic is demonstrated to have little relevance to reasoning in everyday life through a confusion of implication for inference and in translation problems between formal and ordinary language;
2) the conceptual model of antonyms is the basis for a theory of semantic inconsistency in critical reasoning; and
3) the use of semantic inconsistency along with the analytical defeasible model of argument in critical reasoning pedagogy as a natural argument method.

Methodology

The philosophical paradigmatic basis for this research is analytical and pragmatic. The American logician Charles Peirce famously drew the medieval logical distinction between *logica docens* and *logica utens* (Peirce 1901:891–892). *Logica docens* concerns a theory of formal reasoning according to rules and systematic application of those rules (1901:891–892). *Logica utens* concerns our natural practice and habits of reasoning (1901:891–892). Thus, a general analysis of types of reasoning reveals two distinct sets of practices.

To build on and understand these practices, this thesis requires at least three methods: conceptual analysis, historical/systematic study, and pragmatic synthesis. The core idea is confirmed through conceptually analysing “inconsistency” explaining how it entails a family of concepts. The truth functional account is only part of this family. But the use of conceptual analysis is not limited to just the core idea. Logical concepts such as “explosion,” “truth functional,” “antonym,” “gradation,” “negation,” and others are also analysed to settle and understand the various relevant meanings and applications.

The historical/systematic study situates the concept of “inconsistency” from the time of pre-Socratics onwards. Most of the effort is expended on Aristotle’s thoughts on contradiction from *Metaphysics Gamma* (1993). The study creates a backdrop of contrast demonstrating the lack of understanding of inconsistency as a family of concepts. Arguably, it was not until the time of Wittgenstein and his later works that families of concepts were taken seriously (1973:§§244–271). Wittgenstein’s influence is here taken seriously as his thoughts and conceptual description are inspirational in terms of natural language, contradiction and inconsistency.

Pedagogically, the pragmatic focus emphasises what is best for the student in ordinary reasoning, not what is best for the academy or its instructors. It will be contended that no longer should instructors just teach what they were taught in critical reasoning courses themselves, as critical reasoning itself needs to be applied to the pedagogy of critical reasoning.

Each chosen method has its own shortcoming. Historical analyses typically do not provide recommendations for the future and if contexts are not similar enough, inferences from the past may not be worthwhile. To this end, any recommendations must be carefully thought through. Conceptual analyses are limited by usage, which could be wrong or irrelevant. Due to the contextual frame, the analysis may be limited and any extrapolations should be done with correct applicability to multiple contexts in mind. Lastly, pragmatic analyses suffer from a reliance on “agreement” as justification for adopting the result. “Agreement” by whom and why can be a legitimate problem, especially if sources are cherry picked. To stave off these objections, it suffices to add that no one method takes a priority and each is used in a check and balance manner to ensure a triangulation of results.

Two alternative methods are rejected. An empirical method of obtaining data through experiments would require too many variables to be held constant for valid universal results. Experimenting on one population may not be relevant to another population (this is discussed in Ch. 5 with bilingual learners). The degree to which philosophers should engage in empirical studies is questionable as the discipline looks more like a social science if performed. This is not to say results cannot be used for philosophical justification, but generating those results may be beyond the domain of philosophy.

The second alternative method is rejected for a few reasons. The postmodern style of analysis is rejected due to the lack of stability of word meanings, even contextually. This style tends to focus on subjective meaning, where minimally for reasoning, there must be intersubjective meaning for common analysis (Walters 1994:13–14). More so universality and objective application are rejected (Walters 1994:1). While I can appreciate the spirit of the style to focus on the individual and downplay argumentative conflict (Walters 1994:12), individuals are still subject to following norms or the result may be communicative unintelligibility. Norms are necessary to reasoning, at least in some minimal sense and cannot simply be abandoned for personal preference.

Structural outline

Chapter one reviews the systematic and historical understandings of inconsistency. Beginning with Aristotle and his work from *Metaphysics Gamma* (1993), three distinct types of inconsistency are articulated. The three are helpful because they are not bound to propositional logic. Heraclitus's (Graham 2011) and Protagoras's (Taylor and Lee 2014) thoughts are considered as well. Their views are interesting because they both may be advocating "trivialism": the view that all statements are true. From there a discussion of four main paradoxes sets a greater context for semantic and logical considerations: the liar paradox, the sorites paradox, heterological paradox, and paradoxes of material implication. While most of these are more in tune with the concept of contradiction and formal inconsistency; the history still stands as relevant to a broader conception of inconsistency. Next, three modern philosophers, Descartes (1984a, 1984b & 2012) and Arnauld and Nicole (1996) share their additive perspectives on inconsistency. Finally, some 19^{th}–20^{th} century thoughts on inconsistency come from Hegel (2010), Kierkegaard (1936), Camus (1955), Strawson (1952) and the paraconsistent school of Priest and Routley (Sylvan) (1989).

Chapter two presents the formal system of propositional deductive logic. Through a detailed discussion of rules, connectives and symbols, the systematic, consistent nature of propositional logic is demonstrated. The truth functional aspect of propositional logic is revealed to be inherent to the system, based on the nature of the connectives used. A logical connective is used in a truth functional manner to form a sentence from individual components if and only if that sentence's overall truth-value depends only on the truth-value of the individual components. Otherwise, the logical connective is used in a non-truth functional way. A thorough discussion of the meaning of the connectives and their difference from natural language meaning, exhibits the non-intuitive nature of the austere meaning of the connectives. The connectives are explained in terms of both truth tables and inference rules, both of which have their own concept of inconsistency. These concepts are further discussed through logical implication: EFQ *(ex falso quodlibet),* from the false anything follows and ECQ (*ex contradictione quodlibet*), from a contradiction anything follows. Both principles manifest the property of “explosion” showing something rather peculiar about the logical system: the conclusion is not restrained by the premises, such that “anything” follows from falsity and contradiction. Articulating the property of “explosion” in detail is necessary, as it stands to reason that much of the negative connotations of inconsistency come from it. Finally, “anything” following from a contradiction is a misnomer. Rules licence moves and acceptable moves were made to reach that result. So, the arbitrary nature of “explosion” is much more limited than is popularised.

Chapter three critiques the propositional truth functional account of logic. Most of this chapter concentrates on the logical property of “explosiveness,” the concept of “validity,” and why neither correspond to our everyday reasoning practices. Finally, the purported isomorphism between formal language and natural language is challenged, especially in translation and in terms of the material conditional and exclusive disjunction.

Chapter four develops the semantic conception of inconsistency through conceptual analysis and present-day work on antonyms. The lexical-categorical model is presented and rejected in favour of the conceptual model. The rejection hinges on the problems with assuming stable linguistic properties and a simple canon of antonyms. Synonyms share those stable linguistic properties, thus synonyms are antonymic-like, too. The premise is challenged, in particular, the notion of “sharing.” The premise is shown to be more relevant to the conceptual model where antonyms function on gradations, with some being stronger than others. In natural language reasoning, canonical pairs of antonyms rarely occur, so articulating graded antonyms is more robust and sensitive to context, which is what is needed in critical reasoning.

An argument is given showing the temporal priority of semantic inconsistency judgements over truth functional judgements and implicative judgements. From this temporal priority a conceptual priority manifests. Truth conditions factor in to argument evaluation more than argument formation, and are often unknown in everyday reasoning. With the semantic conception of inconsistency, both formation and evaluation take place before considering the truth conditions. The formation aspect relies on antonymic understanding and assessment. The evaluation aspect interprets the truth-values in cases of inconsistency. For example, think about antonymic gradations at the end of the continuum, versus gradations much closer together; the former has a greater potential impact on truth-values than the latter. In the case of the latter, it may be prudent to let the broader context determine the truth-value of the statement instead of letting it weakly contrast with the other antonymic claim. Truth-values are not discarded completely, they still factor in to the evaluation but much later in the process, if they are even known.

Chapter five reviews the pedagogy of propositional logic, the truth functional account of inconsistency and relevant informal fallacies. The early purpose of this chapter is to show how formal deductive logic substitutes for (or is transformed into) critical reasoning in many critical thinking courses. In these instances, critical thinking is being taught as a logic course for all intents and purposes, with the exception of a paper assignment, which contemporary critical reasoning texts such as Moore and Parker (2015), Salmon (2012) and Cederblom and Paulsen (2005) demonstrate. More so, reviewing critical thinking syllabi available alone confirms this approach, for example May (2010), Michelfelder (2011) and Poston (2012).[4] Poston (2012) is also an example of an instructor using a logic textbook, *The Power of Logic* (Snyder, Snyder and Wasserman 2012*)*, for a critical thinking course. The underlying idea is that formal deductive logic is the ideal of reasoning and thus, it is what should be taught in critical thinking classes, too. Thus, the content substitution practice is real and continuing in critical thinking courses.

After demonstrating the content substitution process, the problems with that flawed pedagogy follow. There are a handful of major difficulties which include justifying, or even making sense of, logical connectives that do not match standard natural language meanings. Another problem is attempting to justify the results of formal logic proofs about inconsistency and how anything follows from a

[4] These syllabi were two taken from the first two pages of a Google search on “critical thinking syllabi.” There were others as well.

contradiction in natural language. The final issue involves trying to make sense of applying fallacies that are not black and white but are presented that way.

Chapter six applies the semantic conception of inconsistency to the pedagogy of critical reasoning. Inconsistency can no longer just be about truth-values and the results of formal propositional deductive logic. Instead, logical inconsistency is *one* concept that may be taught in critical reasoning courses. Learning occurs contrastively. By saying something about the truth functional account, the basis is formed for understanding an alternative account, i.e. the semantic conception of inconsistency.

In many ordinary language arguments, the truth of the premises is unknown or questionable. The principle of charity requires us to present an argument in the strongest possible way and in fairness that requires keeping premises that appear to be inconsistent. Students will be taught to look for semantic inconsistencies in ordinary language arguments. From there, students will assess the inconsistency as an important one or not based on semantic conflict of some kind. Minor gradations may not reveal anything problematic; major gradations may reveal conceptual problems or factual reporting problems, but not necessarily. The context also factors in to the intelligibility and ultimately, acceptability or unacceptability of the inconsistency. So, students learn to combine the semantic conception of inconsistency with context analysis to provide the best answer about how to proceed with the argument.

The semantic conception of inconsistency stands as part of the general concept of inconsistency. Inconsistency itself has no necessary value, positive or negative. Students will be introduced to various fallacies that have either an explicit or implicit inconsistency in their conception. This broader look at inconsistency, informed by the prior practice of noticing semantic inconsistencies and context, helps students identify when an inconsistency is substantive and when it is not.

For instance, the *tu quoque fallacy* depends on recognising the inconsistency between what someone says and what someone does. In ordinary idiom, the person is a hypocrite. The problem with this fallacy is that particular contexts justify the inconsistency and it is not a fallacy. The attack on the person is thus minimised in favour of what is being said. For example, if a drug addict tells someone not to use drugs, but is still a user, there is an inconsistency in belief and behaviour. An uninformed conception would charge the person with a fallacy because the person is still an addict and not following his own suggestion. However, rationality tells us that in the case of addiction, the person speaking is an authority on the matter, yet does not have the power to stop the behaviour and desires. Who is better to speak about it? None, the addict has the floor. So, the attack on the person is negated through recognising the value of the person's testimony in context.

Pedagogically, there is a role for the truth functional account of inconsistency as one in a family of inconsistency concepts. However, its role in critical reasoning is minimised in favour of the semantic conception and an informed general concept of inconsistency where context determines the value of inconsistency. Critical reasoning demands as much, if not more from us as instructors.

Chapter seven initially draws out the implications of the previous chapters for logic broadly construed, critical reasoning, and the pedagogy of critical reasoning. For logic, broadly construed, the propositional truth functional account of inconsistency is demonstrated to be systematically limited in meaning and application. For intelligibility, it requires a natural language understanding to make sense of the formal language understanding; the reverse is not possible because all explanations of the formal language would require natural language. This result motivates the implication for critical reasoning as the propositional truth functional account does not capture our ordinary practical intuitions about inconsistency.

A different account – the semantic conception – articulates our ordinary practical conception and is not systematically limited in meaning and application. As natural language comes first, a conception developed from natural language will have priority over any formal caricature of it. In short, the semantic conception is necessary for the truth functional propositional account to have any meaning at all.

This priority in order extends into critical reasoning pedagogy. To learn about inconsistency, semantic inconsistency must be taught first, demonstrating the subtlety of inconsistency judgements and the context-dependency of such judgements. The conceptual antonym theory, with its emphasis on linguistic gradations and contrast of antonyms comports with our experience as competent language users. As students become more capable linguistically, more fidelity can be exercised with such judgements. Students are also taught to recognise the context of the semantic inconsistency in question, and from there, assign the value to the semantic inconsistency. Not all semantic inconsistencies are equal, some matter; others do not. If desired and the time warrants, the propositional truth functional account may be taught after the semantic account as an example of another concept of inconsistency that derives its meaning from the system of propositional logic and its rules.

In the first chapter, the concept of inconsistency is explored in many ways. To appreciate the concept of inconsistency, the contrast between the varying views must be made apparent. This initial chapter sets the foundation for the contrast between the semantic conception and other thoughts about inconsistency.

Chapter 1: A brief history of inconsistency

1.1 Introduction

Emerson (1841:7) famously said: “A foolish consistency is the hobgoblin of little minds, adored by little statesmen and philosophers and divines.” Emerson is touching on something crucial; consistency is not always the *desiradatum*. Philosophers typically prize consistency above all, but there can be good reasons, sometimes excellent reasons, for inconsistency.

The history of philosophy is brimming with discussions of inconsistency in various forms. Some of these are clarifying; others are not. This chapter focuses on some of the major figures and their serious thoughts about inconsistency. Inconsistency can be of at least five different types: metaphysical, psychological, communicative, linguistic, and logical. The historical material that follows addresses each of these although not in a systematic manner. The goal is to frame a line of thought that covers the broad philosophical terrain of inconsistency showing how it is not just historically a single idea, but a multifaceted one that deserves a conceptual explanation. It is also the goal of this chapter to demonstrate that attributions of inconsistency are not always accurate and may be the source of conceptual and historical confusion.

The pre-Socratics such as Heraclitus (2013) and the Sophists such as Protagoras (Plato 1961), and their views on metaphysical inconsistency will be explored, setting the following critique by Aristotle (1941,1955 & 1993) in context. I will expend a good deal of effort articulating Aristotle’s three different formulations of inconsistency or, as it is better known, the *law of non-contradiction* (LNC). The communicative problems with rejecting the LNC in practice are also shown. Views in opposition to Aristotle come next and detail that the LNC suffers in various ways as a first principle but also has problems reconciling the three different formulations as consistent with one another.

Next, a detailed presentation of the main historical paradoxes follows, aiding in understanding the differences among linguistic, logical, and metaphysical paradoxes. Solutions to these paradoxes reveal more about how inconsistency is generated than how to solve it in each respective case. However, this understanding helps form a comprehensive view of inconsistency when something is inconsistent and simply when there is an appearance of inconsistency.

The chapter closes by considering the views of various philosophers and schools that have said something important about inconsistency. These philosophers and schools include Arnauld and Nicole (1996), Descartes (1984a, 1984b & 2012), Hegel (1969 & 2010), existentialist authors Kierkegaard (1936 & 1986) and Camus (1955), and contemporary analytic philosophers Strawson (1952), Priest and Routley (Sylvan) (1989). Given the vast range of analytical philosophy, this final group is limited to major representatives of two ways of thinking about inconsistency – classical and non-classical thought – that are relevant to the overall understanding of the thesis.

In the *Philosophical Investigations* (1973) and *Remarks on the Foundations of Mathematics* (1994), Wittgenstein wrote extensively about contradiction (i.e. logical inconsistency) and paradoxes. In writing about mathematics Wittgenstein (1994:256) states:

> "The pernicious thing is not: to produce a contradiction in the region in which neither the consistent nor the contradictory proposition has any kind of work to accomplish; no, what is pernicious is: not to know how one reached the place where contradiction no longer does any harm."

It is the latter claim that encompasses the spirit of the work in this chapter. Many supposed historical inconsistencies and contradictions may be neither; some may be legitimate yet harmless against traditional historical interpretations.

1.2 Pre-Socratics and Sophists

While there is no clear demarcation of a time period of the pre-Socratics but approximately 6th and 5th century BCE (Curd 2016) and the Sophists of the 5th and 4th century BCE (Struck 2009) , the importance for this thesis is that they both predate Aristotle at 384 BCE (Shields 2016). As Aristotle, in *Metaphysics Gamma* (1993) responded strongly to at least two philosophers from this prior period, they will form the focus of this initial historical section. However, “historical” might be too strong. What this section and others do is analyse perceptions of the philosophers and consider what their original intents were or might be on a charitable interpretation. Part of the methodological problematic is a lack of original source texts coupled with the degree of interpretation apparent in the paraphrases.

Heraclitus (2013:1238) is an obvious target given the controversial nature of his claim about stepping in the same river twice. Some characterise his views into three separate principles: the theory of flux, the theory of the unity of opposites, and his monist ontology (Graham 2011). Our concerns are the first two.

Graham (2011) believes, “… on those stepping into rivers staying the same other and other waters flow [Cleanthes from Arius Didymus from Eusebius]”, has the appropriate linguistic representation of the work of Heraclitus. This contrasts with Plato’s Heraclitus, “I believe, says that all things pass and nothing stays, and comparing existing things to the flow of a river, he says you could not step twice into the same river [Plato *Cratylus* 402a = A6].” The problematic at stake is that the historical influence of Plato’s reading of Heraclitus is likely to have had more of an influence on what Heraclitus supposedly wrote than on what Heraclitus actually wrote by virtue of his exalted status in Western philosophy.[5]

There is a radical difference in intent between the two interpretations. Graham’s is general and poetic; Plato’s interpretation takes some liberty with the

[5] A.N. Whitehead in *Process and Reality* alluded to this very phenomenon when he wrote, “The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato” (1929:39).

original passage. Heraclitus (2013:1238) writes in passage LXXXI, “Into the same river we both step and do not step. We are and are not.” Scholars, including Barnes, use Plato’s interpretation to make adamant claims about Heraclitus, including being inconsistent:

> “That objection alleges logical inconsistency: Heraclitus’ central contention, the Unity thesis, is inconsistent; it flagrantly violates the law of contradiction; hence it is false, necessarily false, and false in a trivial and tedious fashion. It is empty to praise for his scientific insight a thinker whose main and innovatory tenet is a straightforward self- contradiction” (Barnes 1993:60–61).

There are two ways of considering this criticism. First, it is arguing against a position in general, whether correctly ascribed to the philosopher or not. There is something to learn from a charitable interpretation by thinking through the concepts themselves and assessing their values. Second, it is a caricature set up to defeat and show its weakness. It is easy to set up a straw man, by ascribing a view to a philosopher that the philosopher would not agree to and then criticise it as his or her view. It is fair to say, the second way is probably more accurate because of the stronger, more controversial, claim being made.

In fairness to Heraclitus, the river passage is semantically indeterminate in at least one superficial way. The indeterminacy is what creates the confusion. “River” is being used in at least two ways metaphysically; as a type and as a token. As a general type, the river does not change, so one can step into the same river more than once. As a token, however, the river is continuously changing in terms of flow, speed, depth, clarity, and other factors. Without violating any logical ideas, both can be true, so it is not logically inconsistent.

Heraclitus’s unity of opposites has the same tension as the theory of flux. Opposites are joined together. Graham (2011) gives an example of this theory from Heraclitus: “Sea is the purest and most polluted water: for fish drinkable and healthy, for men undrinkable and harmful [B61].” Despite the hyperbole of “most,” Heraclitus is merely showing that with a context shift, the value of something can change. On the surface, this looks to be logically inconsistent: both cannot be true, at least in terms of “purest” and “most polluted.” However, given the context shift based on the differences between humans and fish, both can be true. The more important consideration might be thinking about the semantic inconsistency between “purest” and “most polluted” showing a natural tension. These terms would be incompatible if the context were the same, but they are not. So, Heraclitus’s thoughts form a legitimate example in the history of philosophy where apparent inconsistencies of both types – logical and semantic – are dissolved by paying attention to the context shift.

Protagoras was a Sophist, one member of the group that were paid educators generally understood to be concerned with persuasion (Taylor and Lee 2014). This distinguished them from philosophers whose focus was on truth. For example, Plato’s work is replete with Socrates working in opposition to Sophists, including the dialogue with Protagoras (1961:308–352).

Historically, Protagoras is singled out for being a relativist of some sort (Taylor and Lee 2014). Much like Heraclitus, Protagoras’s philosophy has been pared down to a few simple ideas. This is unfortunate because more could be learned from his philosophical position on life and morality. Protagoras is famous for the idea that “man is the measure of all things”, which reads from Plato’s Collected Works at 151e-152 (1961:856): “Man is the measure of all things, alike of the being that are and of the not-being of things that are not.” Unfortunately, there are no known original surviving manuscripts of Protagoras, so Plato’s version must be considered as the most correct interpretation.

The basic idea at work here is that humans determine the value of their lives. Arguably, that determination is epistemological about what someone believes or not and/or to what someone gives value. However, the “measure passage” could be read in a much stronger metaphysical way making ontological claims about existence, which would generate a clear inconsistency. However, is that what Protagoras had in mind? Protagoras was concerned with morality. Moral claims are not categorically of the same type as metaphysical claims. It seems to me that on a generous reading, Protagoras’s measure claim is much more akin to Ayer as an emotivist (1952:63–77). With morality, an individual determines the value of moral claims as they are subject to feelings and reasons specific to the person. Ayer (1952:68) wrote:

> "For in saying that a certain type of action is right or wrong, I am not making any factual statement, not even a statement about my own state of mind. I am merely expressing certain moral sentiments. And the man who is ostensibly contradicting me is merely expressing his moral sentiments. So that there is plainly no sense in asking which of us is in the right."

Take the case of Steve Biko (SA History 2017), who - like Martin Luther King Jr. (King 1963) in the United States – sought to change the race consciousness of the largely white society making them examine what they actually believed about race relations. Against all odds, Biko held these beliefs against the dominant ideology in society. Setting aside the question of objective morality for the sake of argument, Biko and King both would have held those beliefs as individuals and believed them to be correct. Philosophically, the outcome is that beliefs about value are different from metaphysical facts.

If the preceding thoughts are correct about Protagoras, an individual who adopts the "measure passage" is not logically inconsistent. Where the logical inconsistency can manifest is when other people are placed into the mix, and the value of what they say is considered in contrast or agreement with someone else. However, that potential inconsistency implies that truth-values hold over moral claims, when in theory, moral claims may just be preferences being asserted. If they are merely preferences as the emotivists believe, no truth-values hold over the assertions. As with Heraclitus, if Protagoras is involved in a context shift where morality is not subject to truth claims and is an expression of preference, the "measure passage" raises no real logical or semantic concerns. Of course, the context can be disregarded as an incorrect one, but that is beyond our investigative scope.

One final way that Protagoras can be understood is that he is making a dubious claim about objective, universal knowledge. "Man" or humans are the measure of all things, as a form of subjective belief. This would include moral beliefs. Without objective knowledge, man is the measure of what can be known.

This claim is not that controversial. The history of science shows this form of belief to be true. The difference between the geocentric and heliocentric models of the universe displays that what was thought to be true for humankind for many years was taken as knowledge. In addition, if the instrumentalist about the philosophy of science is right, the Ptolemaic geocentric model is predictive and usable (e.g., Ptolemaic astronomy still allows navigation on the high seas). Is that knowledge? Defining it as such would be the task relative to the philosophical model at work.

However, Plato would disagree. In the *Theaetetus* 201 c-d (1961:908), he argues for justified true belief as the measure of knowledge. What that metaphysically requires is that appearance and reality are the same thing – what we experience and what is there are the same thing – counting as justification for the belief. Arguably, in the geocentric versus heliocentric models of the universe, the geocentric model is merely an appearance without a corresponding reality, whereas in the heliocentric model appearance and reality correspond, thus, counting as knowledge in accordance with Plato's definition. From an objective standpoint, this is a reasonable interpretation. But is it a fair interpretation? After the fact, knowledge claims prove little when the perspective of the knowledge claim is relevant to the value and quality of it. Protagoras recognises that very fact of the standpoint. Thus, appearance and reality are the same for him at that time until proven differently and then at a later time, something else is proven such as the heliocentric model. Plato's criticism relies on the two metaphysical distinctions being true, another theoretical posit which generates potentially inconsistent claims. Accordingly, inconsistency can have much deeper roots.

1.3 Aristotle

Aristotle was arguably the first philosopher to seriously consider the philosophical aspects of inconsistency and contradiction. In *Metaphysics Gamma* (1993), Aristotle writes at length about contradiction and intelligibility. The initial part of this section introduces his three different formulations of the law of non-contradiction. The latter part of this section considers some responses to Aristotle's thoughts.

1.3.1 The law of non-contradiction

In *Metaphysics Gamma* (1993), Aristotle covers a number of logical and metaphysical topics. One of these topics has a unique character. In particular, he addresses "… the firmest of all principles …" and a "… principle about which it is impossible to be in error …" which is the law of non-contradiction (LNC) (Aristotle 1993:14–21). In *Metaphysics Gamma*, Aristotle states that this principle can be demonstrated through the method of refutation but not directly proven (1993:1006a: 1–10). There are three different formulations of the LNC found in *Metaphysics Gamma*: ontological law of non-contradiction, logical law of non-contradiction, and psychological law of non-contradiction, each is defined in turn:[6]

> From 1005b, the ontological formulation of the LNC (OLNC): "For the same thing to hold good and not to hold good simultaneously of the same thing and in the same respect is impossible" (1993:19–21).
>
> From 1011b, the logical formulation of the LNC (LLNC): "It has now been fully enough stated that the opinion that opposite assertions are not simultaneously true is the firmest of all …" (1993: 13–14).
>
> From 1005 b, the psychological formulation of the LNC (PLNC): "For it is impossible for anyone to believe that the same thing is and is not …" (1993: 22–25).

The OLNC is a strong formulation that many hold to be self-evidently true given that it deals with the basic constituents of reality. Under any normal articulation (i.e. non-quantum physics), it is metaphysically impossible for something to be (in the same time and same sense) and not to be (in the same time and same sense). At the same time and in the same sense, no one can both be in California and not be in California. While some, such as Hegel (2010) and Priest & Routley (Sylvan) (1989), might challenge this formulation, these philosophers and their ideas will be addressed later.

However, are the other two formulations (i.e. LLNC and PLNC) as strong and do they hold in an equally rigorous way? For Aristotle, the LLNC is as strong

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[6] This tripartite division of the LNC was first thoroughly formulated by Łukasiewicz (1971) in his interpretation of Aristotle's *Metaphysics gamma*.

as the OLNC, as he qualifies that as “the firmest of all” (1993:13–14). The sentence: “Scott is in California and Scott is not in California”, according to this formulation is not true because – as per bivalent logic – the individual conjunctive statements are not true at the same time. One statement is true but not the other statement because of the function of negation. In fairness to Aristotle, this formulation holds true in classical logic, even axiom like, or as a law of thought. Aristotle’s thoughts on these matters stood for millennia as the definitive thoughts on contradiction, especially logical contradiction. It is only in recent years that non-standard logics have challenged the LLNC, such as the work of Priest and Routley (Sylvan) (1989).

According to Aristotle, the PLNC is equally as strong as the OLNC and the LLNC, given the modal language of the “impossibility” of believing “… the same thing is and is not …” (1993:22–25). The act of believing contradictory propositions is impossible for Aristotle, as he puts forth in *Metaphysics Gamma*, 1005b (1993:26–33):

> “But if it is not possible for contraries to hold good of the same thing simultaneously … and the opinion contrary to an opinion is that of the contradictory, obviously it is impossible for the same person to believe simultaneously that the same thing is and is not …”

Note the “hold good” from the OLNC and “believe” from the PLNC as his structuring (or isomorphism) of the two formulations. Aristotle is arguing that the relationships of things in the world determine the structure of thought. If the OLNC holds, then so will the PLNC. For Aristotle, it is important that all three LNC’s align and have similar if not the same strength, to keep them the “firmest of all” formulations that guide thought (1993:13–14).

1.3.2 Aristotle on the Pre-Socratics

In *Metaphysics Gamma* (1993:6–11 & 25–32), Aristotle considers the thoughts of both Heraclitus and Protagoras and finds them lacking in intelligibility. This is not surprising because, for Aristotle, both are violating one or more formulations of the LNC.

Arguably, what grounds Aristotle's thinking on contradiction is his essentialism as manifested in his ontological conception of contradiction (1993:19–21). Aristotle believes that things have essential or necessary properties that the thing would not be if it did not have those properties.[7] Human beings are essentially rational for Aristotle such that if a human being is not rational, it is not a human being. Essential properties, in the Aristotelian estimation, are to be distinguished from accidental properties, such that accidental properties are not necessary for a thing to possess, for example, paleness (Cohen 2016:§5–7).

In *Metaphysics Gamma*, 1005b, Aristotle (1993:25–26) attributes the following thesis to Heraclitus: "For it is impossible for anyone to believe that the same thing is and is not, as some consider Heraclitus said…" Suppose the world of essences is true. Things in the world cannot both possess and not possess necessary properties. Beliefs about the world should correspond to the world in Aristotelian epistemology. So to explicate the above quote: Aristotle claims that Heraclitus holds that someone can believe the thing both is and is not. This generates a problem for Aristotle (1993: 29–30), because he argues that "...the opinion contrary to an opinion is that of a contradictory" (1005b). In terms of the "river passage" previously discussed, this point would be articulated that someone believes both that the river stays the same and does not believe the river stays the same. In 1005b (1993:31–32), Aristotle continues: "... then obviously it is impossible for the same person to believe simultaneously that the same thing is and is not." Thus, you cannot believe the river is both the same and something other than a river.

Aristotle's basic criticism from his LNC broadly construed, is that someone cannot hold contradictory beliefs. This manifests from his essentialism, augmented by his further belief that PLNC is so basic that it serves as a foundation for axioms (i.e. self-evident truths). In *Metaphysics Gamma* 1005b (1993:34), Aristotle writes: "... it is, in the nature of things, principles of all the other axioms also." Before self-evident truths arise, the PLNC is in place for intelligibility.

[7] See in particular, Aristotle's *Posterior Analytics* (1941:75a[120-121]).

So, while axioms might be the topic of a discussion, the PLNC is not. It can only be given the foundational role it serves in guiding our thinking and practices.

In *Metaphysics Gamma*, Aristotle turns to Protagoras. He writes in 1009 (1993:6–11):

> “For if everything that is thought or imagined is true, it is necessary that everything should be simultaneously true and false; for many people have mutually contrary beliefs, and regard those whose opinions are not the same as their own as in error, so that it is necessary that the same thing should be and not be.”

Returning to Protagoras’s idea that “man is the measure of all things,” the social consequence is that people have opposing beliefs, and they are not in error. Thus, something could be and not be based on the opinion of individuals, as the opinion logically determines the truth-value, not the world or what it is.

This consequence flies in the face of Aristotle’s PLNC and essentialism. Essential properties are identifiable—they constitute what something is: ontology is not subject to debate. Accidental or contingent properties may be subject to debate, but they are not the focus of Aristotle’s criticism of Protagoras. For Aristotle, contrary opinions cannot both be true based on the PLNC and the way the world is essentially via the OLNC. The structuring element of both LNCs cannot be denied, as they are required for the basic intelligibility of the world. Thus, Protagoras’s subjectivist thesis fails to gain any philosophical ground for Aristotle.

1.3.3 Contemporary criticisms of Aristotle on the LNC

Aristotle’s influence on logic as a whole still carries on today. In recent times, he has been the subject of various criticisms about the LNC. Some of these centre on the supposed indubitability of the LNC, e.g. Cohen (1986), and others focus on specific problems with Aristotle’s conceptions of the LNCs, e.g. Łukasiewicz (1971) and Priest (1998 & 2006). Typically, the attacks on the LNC centre on one of two themes; either they object to the foundational principle aspect, or they object to one or more of the laws directly.

1.3.3.1 Cohen

Cohen’s (1986) discussion of the literature on Aristotle is wide-ranging, especially of Code’s (1986) and Irwin’s (1977) works on Aristotle. There he debates argument type and Aristotle’s goals. Those will be set aside for our purposes. However, Cohen adds two critical points to the overall debate, one about the indubitability of the LNC (based on a knowledge distinction) and an argument about the success of Aristotle (demonstrating the indubitability of the LNC).

Cohen references an earlier Aristotelian work than the *Metaphysics*, the *Posterior Analytics* (1941:75b[121] & 100b[185–186]), setting up a distinction about how first principles can be known. Cohen (1986:360) writes:

> “Aristotle’s solution in the *Posterior Analytics* is to distinguish between *episteme* (i.e., scientific knowledge) and *nous* (i.e., intuitive intellect). First principles, such as PNC [LNC in our terminology], are not objects of scientific knowledge—since they are not demonstrable—but are still known, since they are grasped by *nous*.”

The distinction between *episteme* and *nous* fundamentally answers the question about how a general principle like the LNC can be known. Scientific knowledge is subject to the senses and verification, or empirical methodology. Testing general logical principles would be difficult because the example of the principle is not the principle itself. However, if general logical principles are known by intuition, it explains how we have the principle available to us. Aristotle does not rely on this distinction in *Metaphysics*, instead appealing to a series of elenctic demonstrations per Cohen (1986:369). I suspect Aristotle’s intent was to prime ordinary intuitions about the LNC, but not to go as far as demonstrating its truth.

The second point found in Cohen’s work is the consequence of an argument about the indubitability of the LNC. Cohen (1986:367–368) argues, supposing *G* is any arbitrary predicate, and *a* is any arbitrary object, then:

1. Everyone believes that ~(Ga & ~Ga). From (1) it is legitimate to generalise to:

2. $(\forall x)(\forall F)$(everyone believes that $\sim[Fx \ \& \sim Fx]$). However, (2) does not assert the indubitability of PNC, which would be represented by a different formula:

3. Everyone believes that $(\forall x)(\forall F) \sim(Fx \ \& \sim Fx)$.

Cohen's strategy is to start with a specific instance (1) of the LNC that everyone believes. From there, he generalises to a quantified version (2) wherefore any predicate and object and its negation, everyone is going to believe the conjunction is not the case. Quantifying over the belief clause does not ensure it is undoubtable. To be undoubtable (3), he moves the clause outside of the quantification, which changes the scope of belief to any arbitrary predicate and its object. However, (3) does not seem to follow any known inference principle. Cohen (1986:386) states: "But it is not obvious that 2 entails 3, for it is not evident that one may legitimately import external quantifiers into a belief context." This is a subtle logical point because what is at stake are the instantiated beliefs that one has that stand as true, but these instances do not necessarily imply that all of one's beliefs with the same logical form are true. This is not necessarily Cohen's point, but this is a generalisation fallacy of sorts where from particular instances of a logical form, a universal claim of the same form is made. So, then it seems that Cohen's criticism could directly apply to the PLNC. The criticism raises a concern: if everyone does believe that PLNC is true then it might be because particular instances (claim 1) do not necessarily entail a universal (claim 3).

To extrapolate from Cohen's two points, a few things may follow. If the *nous* and *episteme* distinction holds, the LNC and its variants are not demonstrable but known intuitively. This would imply that, potentially, the PLNC is the strongest formulation given the nature of belief and its relation to intuition. However, this formulation is substantiated by Aristotle's essentialism. But this metaphysical view needs to be justified and this is problematic, because one cannot simply assume that there are essences, without verification and repeatability. The very phenomena that Aristotle uses to derive essences can be explained by non-essentialistic accounts like Wittgenstein's family resemblances (1973:§§244–271). The elenctic demonstrations of the *Metaphysics* seem to go in the other direction for Aristotle, to the *episteme* category. Cohen's second point supports this direction, as instances of the LNC in everyday life are used to justify the general principle LNC (1986:367–369). The result of both points is that what once looked to be an unshakeable principle is not so firm or clear to justify.

1.3.3.2 Łukasiewicz

Łukasiewicz was a Polish logician who wrote extensively on Aristotle's logic. He was the first to write about the three different versions of Aristotle's LNC wherein he examines each of the LNCs in turn (1971:488). He believes that the OLNC and LLNC share some correspondence, as language is representative of what is the world (1971:488). The LLNC and the PLNC also share a similar correspondence, as the propositions expressed by the LLNC align with the beliefs of the PLNC (1971:488). Supposing the principle of correspondence, the OLNC and the PLNC can potentially align showing that beliefs correspond to the world, and propositions are the vehicle for communicating this correspondence. Unfortunately, the PLNC is not on the same philosophical footing as the other two, so more needs to be said about why this is the case.

Since our concerns to a great extent in this thesis are inconsistent beliefs, the PLNC is of particular interest. Łukasiewicz argues that Aristotle's proof of the PLNC is not complete (Dixon 2000:23). Łukasiewicz writes (1971:491), "Aristotle's proof of the psychological principle of contradiction is incomplete because Aristotle did not demonstrate that acts of believing which correspond to contradictory propositions are incompatible." Aristotle did not carry out the proof of the principle in sufficient detail to justify it. The major hurdle Aristotle faced was the incompatibility of contradictory propositions with contradictory beliefs (1971:491). Łukasiewicz (1971:489–491) attacks this incompatibility on two fronts, resulting in an indictment of the PLNC (Dixon 2000:24).

The first front delves into Aristotle's account of ordering relations. Consider a range of relations; on the ends, the relations are opposed or contradictory. They are the farthest from each other in the series. Łukasiewicz (1971:491) states:

"Aristotle adopts as the ordering relation of the acts of believing the difference in their degree of being true or being false, and even speaks of 'truer' and 'falser' beliefs." Łukasiewicz (1971:491–492) believes this is an error–Aristotle has a mistaken notion of what "true" and "false" mean because the terms are not subject to differences in degree. More so, Łukasiewicz (1971:491–492) does not believe that beliefs are true or false, just the same for emotions or feelings. However, propositions or those subject to the LLNC are true or false, and they can be relative in a range of ordering relations to the world (think about a mixed breed dog; it has something of both breeds but not a full representation of those breeds). Hence, the first front denies that there are degrees in truth and falsity of beliefs, and second, it denies that beliefs have truth-values at all (Dixon 2000:24).[8]

The second front attacks from a psychological position. Łukasiewicz accuses Aristotle of committing the fallacy of "logicism in psychology" or its counterpart "psychologism in logic," which is attempting to explain logic by the workings of the mind (1971:491). *Per* Łukasiewicz (1971:491–493), Aristotle's focus is on the relations between propositions, not beliefs. To assume the same logical relation holds between beliefs that holds between propositions is to equate psychological causality with logical succession (1971:492). Frege (1980:xxii) confronts this psychological notion by arguing that the logical must be separated from the psychological because of the former being subjective and the latter being objective. Thus, the fallacies Aristotle purports to commit share the dubious assumption of explaining logic by an appeal to psychology, which is deeply problematic according to Łukasiewicz (1971:491), Frege (1980:xxii), and Dixon (2000:25).

Łukasiewicz ends his criticism of Aristotle with three final thoughts about the PLNC (Dixon 2000:25). First, the PLNC cannot be demonstrated *a priori* but at most can be inferred as a law of experience (1971:492). By considering the correspondence between the OLNC and LLNC, a proposition can be verified in experience. The LLNC then stands verified, and if it corresponds with the PLNC,

[8] Łukasiewicz does not provide any sustained argument about the gradation of beliefs and why "true" and "false" cannot be part of the gradation of belief.

at best, it is an inference from experience and not something known *a priori*. This has strong ramifications to its justifiability as a necessary principle. *A priori* justifications are generally stronger than inductive justifications due to their unchanging nature and lack of reliance on experience (Dixon 2000:25).

Second, Łukasiewicz (1971:493) does not believe the PLNC has been empirically demonstrated. Do people hold contradictory beliefs or not? Łukasiewicz cites a passage from Husserl (1900:82), where Husserl opined about a man holding opposing thoughts that were true at the same time.[9] If the PLNC is not a principle of *nous*, it must be empirically demonstrable, and since it has not been, it is a principle without proof (Dixon 2000:26).

Finally, Łukasiewicz builds upon the previous point and probes the provability of PLNC. By appealing to the history of philosophy, Łukasiewicz (1971:492–493) cites a passage from Hegel on the paradox of motion. In this example, something is both here and not here in a single instance, much like moving through a doorway—at one time, it is both in and not in the doorway, and vice-versa (Hegel 2010:382).[10] The consequence for Łukasiewicz is that there have been times, or currently are times, when someone asserts a contradiction with full belief and awareness that he/she was completely aware of his or her actions (Dixon 2000:26). To have this kind of self-awareness of a living contradiction strongly opposes Aristotle's thoughts on being able to hold contradictory beliefs at the same time and in the same sense. If Aristotle desires to make the PLNC work, he must adopt an *ad hoc* measure to understand how someone with full awareness can hold this type of belief (Dixon 2006:26). Aristotle's response is that what someone says he or she believes and reports

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[9] Husserl (1900:82) writes, "In the same individual, or still better, in the same consciousness, contrary acts of believing could never persist during even the smallest interval of time. But is this really a law? May we really state it with unlimited generality? Where are the psychological inductions which justify its adoption? Might there not have been and might there not be men, who confused by fallacies for instance, occasionally held opposites to be true simultaneously? Has scientific research been conducted as to whether something like this does not occur among the insane and perhaps even in plain contradictions? How does the hypothesis fare with the conditions of fever delirium, etc.? Is the law also valid for animals?"

[10] I am using a modern English translation of Hegel, Łukasiewicz cited the original German, *Wissenschaft der Logik*, Werke, vol. IV, Berlin, 1834, p. 69. The material is found in the footnote at the bottom of pgs. 492 and 493 in Łukasiewicz (1971).

through a linguistic expression is different from what that person actually believes about the object or thing in question (1971:493). Thus, in the Aristotelian conception, a linguistic report does not need to correspond with beliefs. This lack of correspondence between beliefs and the linguistic report then negatively affects the corresponding LNC formula hypothesis, which further displaces the importance of the PLNC (1971:493).

Supposing for a moment that Łukasiewicz is correct then the OLNC and LLNC are on different ground than the PLNC. The PLNC is severely weakened by Łukasiewicz's attack and may not be salvageable. Coupling this with Cohen's position on the PLNC, the PLNC is subject to multiple objections and problems in formulation and in practice.

1.3.3.3 Dancy

Dancy (1975) provides a detailed interpretation of Aristotle's thoughts in the *Metaphysics*. This interpretation is wide-ranging and speaks to many aspects of the arguments Aristotle marshals in an effort to defend and substantiate the LNC in *Metaphysics Gamma* sections 3 and 4 (1993). For the purposes of this thesis, one section of Dancy's work is particularly relevant on how Aristotle can justify the LNC at all.

Dancy (1975:Ch.1) questions the status of the LNC. Is it an axiom of logic and argument, an axiom of all thought, or a rule of inference? Starting with the latter, it is not like *modus ponens*; it does not licence any logical moves, so it is not a rule of inference (1975:11). Next, he considers the first idea of the LNC as an axiom of logic, but he quickly dismisses it as not necessary for every logical proof or even validity such as Euclid's first proposition that is done with just identity.[11] However, what should be made of the second idea of the LNC being an axiom (or better, presupposition) of all thought? Is it something that needs to be in place for there to be any coherent and logical thought at all? Dancy (1975:9) states:

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[11] See, for instance, Joyce (2010) for the proof from Euclid's *Book I*.

> "The pattern that is supposed to show the priority of the law of contradiction, or of whatever law you pick, is close to that of a "transcendental argument": we are supposed to see that there is a certain practice, that of arguing, and that the law of non-contradiction is fundamental to that practice. The point here is that if this pattern is to be used in support of any particular presumptive law of logic, what has to be shown is that particular law is fundamental to the practice."

On one formulation (Stern 2015), transcendental arguments argue from the necessary condition X to the possibility of Y but, since Y does take place, X is then justified, too. Instantiated, the LNC is a necessary condition for communication to take place; communication does occur so the LNC must exist. Another way to understand this is that from the very fact that we communicate demonstrates that something is ordering that, and the LNC would be a part of organising and making communication intelligible. Whether this is a persuasive argument or explanation is subject to debate. However, it does provide some sense of understanding of how a principle like the LNC gains intelligibility for Aristotle, and for many of us as well.

Suppose for a moment that the previous is true; while it is not pointed out by Dancy, the practical focus appears to be a red herring of sorts. Roughly, humans communicate intelligibly and effectively, because logical laws – like the LNC or the law of excluded middle – are in place. The import of that is that there is a practical structuring to communication. However, what does this practical result have to do with the logical, systematic aspect of the LNC? The LNC is taught in contemporary times to be part of a logical system: the system of propositional logic.[12] The LNC takes on a different role there, and the same communicative justification does not hold as strongly. Paraconsistent logics reject the LNC – in particular, *ex contradictione quodlibet* (ECQ) – such that anything follows from a contradiction. Does ECQ hold in practicality? No, if someone contradicts him or herself, no one thinks that anything whatsoever follows from that contradiction. So, when the practical aspect is brought in to explain the LNC and its place in a logical system is set aside, a red herring results because the focus of the

[12] In fairness to Aristotle, propositional logic in the contemporary form taught did not exist during his lifetime. However, if the LNC is that foundational of a principle, it should transcend logical systems for the classically minded logician.

argument or explanation has changed. The context has shifted to a practical point, not a formal logical one.

The question to be answered then would be to what extent Aristotle's defences of the LNC are applicable to logical systems and beliefs today. Unfortunately, without a deep commitment to essentialism and the corresponding aspects of his three LNCs, Aristotle's thoughts are marginalised, to some degree depending on the logical system and commitments. The transcendental point is not so easy to bypass unless one grants that the PLNC is the weakest of the three formulations and can be doubted or shown to be outright false. Dancy (1975:13) takes an interesting position with respect to giving up a practical formulation of the LNC:

> "Wholesale, or arbitrary, abandonment of the law of non-contradiction might leave us without a handle on the notion of intellectual agreement. But, first it is not clear how much we need that sort of intellectual agreement, and, second, even allowing that we need a good deal of it to cope with things, it is not clear how much of it we would be giving up if we let the law of non-contradiction slip now and then."

It is not too controversial to read Dancy here as undermining the necessity of the LNC for practical communication in all cases. The idea of intellectual agreement might be a different species of agreement based on ideas alone with limited practical application, whereas practical application as the primary focus is more empirical. There could be intellectual and practical cases where it is acceptable to abandon the LNC without harming the communicative process. Does this undermine the transcendental point? Perhaps not, for the point could still stand with humans realising when something important hangs on it or not. However, Aristotle would have no need to agree with any of it, as his distinction between what someone says and what someone believes would stand.

1.3.3.4 Aristotle's critics: some reflexions

Critical analysis in philosophy occurs after the fact, and in this case, thousands of years after Aristotle put forth his philosophical thoughts. With the LNC, Aristotle in *Gamma* 1006b sought to have a firm foundation for basic intelligibility (1993:9–10). The practical point mentioned previously shows the communicative difficulty with performative contradictions. Aristotle, it seems, was pointing out a fact of our existence as humans. This is the strength of Aristotle's thoughts on the LNC and its variants. But, Cohen, Dancy and Łukasiewicz raise a whole host of other problems for the LNC when the LNC is not nested in communicative practices.

Are these recent criticisms justified? Philosophically, yes to some degree in the right context. If someone were attempting to justify the LNC through Aristotle's arguments, the criticism of the three must be taken into account. I think Cohen's point is right that from particular instances a principle cannot be justified and it applies to Aristotle in this case.[13] It is a particularly devastating objection if we assume Aristotle was a foundationalist with respect to the LNC because the LNC is not foundational given his own posits, if the critics are correct. Articulating three different versions of the LNC opens further objections about reduction to one another and the priority thereof, which were discussed with Dancy and Łukasiewicz. Were Aristotle alive and able to respond, maybe the criticisms could be handled by further elucidation. Alternatively, imagine a discussion of contradiction without Aristotle's thoughts. That discussion would be a strawman due to not having a seminal logical figure who wrote extensively on it. Aristotle must be included and the philosophical consequences are the implications of recent scholarship that is technical and demanding.

1.4 Historical paradoxes

Inconsistencies relate to paradoxes – situations that are contradictory or inconsistent – wherein there is a conflict of ideas or qualities. This common understanding of "paradox," articulates that inconsistency is philosophically problematic and needs resolution. Of course, philosophers have long dealt with paradoxes of both logical, and more broadly, philosophical varieties, such as Zeno's multiple paradoxes (Hugget 2010) of motion, and those that arise from quantum mechanics, such as "Schrödinger's cat" (Faye 2014). So, paradoxes continue to be part of our philosophical lives.

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[13] This is supposing the *nous/episteme* distinction.

Sainsbury (1995:1) defines a paradox as inferring an apparently unacceptable conclusion from apparently acceptable premises. “Apparently” does a great deal of work in the definition, as it leads to diagnosing the problem: either the reasoning is bad, one or more of the premises is false or ill-constructed, or the conclusion should be accepted without reservation. Most popular paradoxes can be articulated this way in terms of failing one (or more) of the three diagnoses.

This section focuses on natural language paradoxes. Both of these types of paradoxes – i.e. vagueness and self-reference – result in logical and/or semantic inconsistency. The sorites paradox and it variants – such as the “bald man” paradox – generally arise because of the vagueness in the application of particular predicates such as “heap,” “pile,” “bald,” and many others. The predicates clearly apply in some cases but not in others. Yet, the middle or vague area of application raises questions. The liar paradox and the heterological paradox stem from problems of self-reference in natural language. Self-reference generates inconsistency, but the significance of the inconsistency is questionable. Finally, the paradoxes of material implication demonstrate how logical principles violate our intuitions about inference in ordinary language. The inconsistency is at a higher-level between languages, a formal one and an informal or natural one.

1.4.1 The sorites paradox

The sorites paradox rests on minute changes where one of those changes is significant. Assume the following: PILE = if we remove one grain of sand from the existing pile, then removal of that grain will not change the pile of sand into a non-pile of sand. Formalising the argument with *modus ponens*,

1. Assume a 100,000-grain pile.
2. PILE is true.
3. If PILE is true, then pile minus a single grain is still a pile.
4. Therefore, pile minus a single grain is still a pile.

Applying the argument recursively, where the value of PILE in premise 3 decreases by one on each iteration, eventually, even a single grain remaining is still a pile. As the argument is stated, the problematic premise is 3. The antecedent “PILE is true” can be true while the consequent “pile minus a single grain is still a pile” is false. When this false consequent occurs is up to debate.

Solutions to the sorites paradox are numerous. Some accept the conclusion, which is not intuitive (Sainsbury 1995:31). The idea behind it is that vague concepts are defective and are not applicable. Sainsbury contends that words such as “pile,” “heap,” and “bald” commit us to absurdities demonstrating something about them, not the reasoning (1995:31). Arguably, this is not a strong solution, but it is an important one because it impugns the linguistic side, not the logical side.

A second linguistic solution is the penumbra, or supervaluation, approach. There are clearly areas of proper application and not of a vague predicate, but the not so clear cases are in a grey area or penumbra (Sainsbury 1995:35). The penumbra is a truth-value gap, where the predicate is not true or false. This solution ultimately rejects premise 3, because losing a grain does not sustain the application of the predicate in the consequent supposing the penumbra. Arguably, the weakness of this approach is that it supposes at least a three-valued logic, which undermines classical logic sensibilities.

A third linguistic solution is the hard line or epistemic approach. There is a definite line or point in the progression of the pile where losing a single grain it is no longer a pile (Sainsbury 1995:32). There is no penumbra, no grey area or area of indecision. Cargile (1969:193–195) uses the imagery of a tadpole becoming a frog, with a photo being taken at very small intervals. At some point, there is a clear photo of the frog that was once a tadpole, thus, demonstrating the clear application of the predicate “is a frog” or “is not a tadpole.” Arguably, the weakness of this approach is that clear application of a predicate is not always obvious, given that the world is not so finely grained as logic and mathematics, especially when minutes can reduce portions of seconds.

The final linguistic (and logical) solution accepts the conclusion in the first solution but does so in a different way. The paraconsistent approach admits the conclusion is both true and false. The conclusion is true that it is a pile, and the conclusion is false that it is a pile. This truth-value, “glut,” is the conceptual manifestation of a vague predicate.[14] Just as in the initial solution, this is not intuitive and violates classical logical sensibilities. However, the logical system might be what is generating the paradox, thus, by adopting an inconsistency tolerant logic, there is a different result.

1.4.2 The liar paradox

The liar paradox is a semantic paradox of self-reference. The paradox is generated when bivalent truth-values, combined with self-reference, conflict. Assume the following statement (LIAR) = This statement is false:

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1. If (LIAR) is true, then “This statement is false” is true (is false).
2. If (LIAR) is false, then “This statement is false” is false (is true).
3. 1 is true (false) if and only if 2 is false (true).
4. Therefore, the (LIAR) is both true and false.

The argument gains its paradoxical status as 4 is entailed by both 1 and 2. The parenthetical truth-value shows the iteration of truth-values in a never-ending sequence. Premises 1 and 2 contain contradictions in their conceptions when iterated. Premise 3 demonstrates the self-referential nature of 1 and 2 and their dependence on each other for intelligibility. There are other versions of the liar paradox, which introduce new problems for any solution.[15] They tend to be stronger and subject to other considerations that are not applicable to the purposes here.

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[14] A truth value “glut” means the truth value is overdetermined as it is both true and false. This is to be contrasted with a truth value gap, where the truth value is underdetermined as it is neither true or false (Cook 2009:119).

[15] For other versions of the paradox see, Beall and Glanzberg (2014).

Instead, something much more important about the structure of language is called into question by the classical liar. The classical liar is the result of self-reference illuminating, which is a peculiarity of natural language. The implication is that ordinary language is inconsistent. When self-reference is combined with bivalent truth-values, inconsistency follows. How then would a solution look and how can it address this structural deficiency?

Tarski (1996:66–68) recognises this inconsistency about natural language and develops a response with a hierarchy of languages (metalanguage and object language) that purportedly escapes the inconsistency by moving the truth predicate from the object language to the metalanguage. This solution keeps classical logic intact but suffers from a different problem; the inconsistency just manifests at a higher-level, as Soames (1999:54) demonstrates. If the inconsistency of natural language which generates the problem cannot be solved, what solutions are available?

There are two basic ways a solution can go. The first solution is a truth-value gap, where the liar is not true or false because it fails to express a statement capable of a truth-value (Beall and Glanzberg 2014). The statement itself is subject to a context where truth may or may not be predicated of it. This contextual solution then allows an explanation of the classical liar but also of the "This sentence is false" in a context such as pointing to a sentence or referring indexically in a book that is factually inaccurate. This solution, and others like it, keeps classical logic intact but relies on shifting contexts to do so. Whether that is desirable or even acceptable is up for discussion.

The second solution is a truth-value glut, where the liar is both true and false, which is a contradiction (Beall and Glanzberg 2014). This solution embraces the inconsistency of natural language but at the cost of classical logic. It is a radical solution logically, but considering the results of Tarski's (1996:66–67) investigation on semantically closed languages, the logical solution through paraconsistency corresponds to the linguistic inconsistency problem. The bigger question here, logically, is the idea that contradictions entail everything, and if an ordinary language has a contradiction like the liar in it, does that mean that the language loses its meaning and structure? In practice, words retain their meaning and use, so if there is a problem with the contradiction, it must be manifesting somewhere else outside of human linguistic practice.

There is an additional solution to the liar paradox that is not prevalent in the contemporary literature. Wittgenstein (1994:255) writes: “Let us suppose that a contradiction in an order, e.g. produces astonishment and indecision—and now we say; that is just the purpose of contradiction in this language game.” Wittgenstein’s thoughts are subtle, what he is stating is that a general rule of dealing with contradiction is not what we are after. Instead, contradictions can serve different functions in different linguistic contexts. The liar paradox might be best expressed then as: “Look here … language is on a holiday; do not take it too seriously.” Let us not rewrite our logic and practices based on this one sentence. This is sage advice from an ordinary perspective, but not often taken.

1.4.3 The heterological paradox

The heterological paradox is a semantic paradox of self-reference. The paradox is generated when a term is applied to itself. Assume the following definitions: *heterological* means an adjective that does not describe itself, and *autological* means an adjective that does describe itself. “Long” is heterological because it is not a long word. “Short” is autological because it is a short word (Sainsbury 1995:147). Consider the following argument:

1. If heterological is *heterological*, then it is *autological.*
2. If heterological is *autological,* then it is *heterological*.
3. 1 is true if and only if 2 is true.
4. Therefore, heterological is both *heterological* and *autological.*

The argument gets its paradoxical status as 4 is the logical consequence of premises 1 and 2. Premise 3 demonstrates the self-referential nature of 1 and 2 and their dependence on each other for intelligibility.

This is another self-referential paradox, but it does not use truth-values to generate the paradox. Instead, the linguistic meaning produces the semantic conflict. A possible solution to the paradox is addressing the conflict in the most direct way. Cargile (2009:299) offers a novel solution to the paradox; he states:

> "Just as there is no such property as being heterological, there is no property of being a property which does not have itself as an instance. Most properties do not have themselves as instances."

Cargile (2009:299) is challenging the antecedents of premises 1 and 2. For instance, the property of handsomeness does not itself have "handsomeness" as an instance. "Heterological" and "autological" seem to follow suit as they themselves do not count as instances of the words. It is the peculiar notion of self-reference in this case that leads to thinking they themselves need to be instances, when, according to Cargile, the words themselves do not have themselves as being instances. I think this is a plausible solution to a problem for self-reference paradoxes, in particular, the heterological paradox.

1.4.4 Linguistic paradox of material implication

The paradoxes of material implication are logical paradoxes generated by the nature of the material conditional in logic. Implication is a general logical relation or connection between two or more statements, where one idea follows from another idea. The fact that it is raining outside implies that the roads might be slippery. Implication, semantically, is thought of as "implies" or "if…then". It is this latter idea that serves the language of material implication in logic. However, our ordinary intuitions about "if…then" are seemingly not represented by material implication. Typically, "if…then" statements demonstrate a necessary relationship between two other statements (e.g., if it is raining, then my car is getting wet). The material conditional, which represents material implication in logic, does not seem to capture this natural language necessity very well.

There are paradoxes of material implication that originate from the way the truth table diagram determines the truth-value for the material conditional. A discussion of those will come in a later section in this thesis. Instead, there is a higher-level paradox worth discussing about the relationship between the logical language and natural language.

The material conditional in logic has truth conditions that are not well-represented in natural language, and it is where the higher-level paradox originates. Consider the following:

1. Semantic content creates a meaningful relationship between the antecedent and the consequent in a conditional statement.
2. The truth-value of the material conditional is determined by the truth-values of its antecedent and consequent.
3. The truth-value of the material conditional is not determined by the semantic content of the antecedent and consequent.
4. Thus, the meaningful relationship of semantic content is irrelevant to the truth of the material conditional.

Conclusion 4 is difficult to accept if we suppose that our arguments should have some grounding in the ordinary world of linguistic usage. Premises 1–3 are accurate and represent the traditional model of translating ordinary language statements into logical language. The interesting thing to note is that without the translation process, there is no paradox as the meanings of each language – both formal and ordinary – are intact, and thus no conflict arises. So, the higher-level paradox arises when the two languages are thought to comport in meaning.

1.5 Other influential ideas and philosophers

In the history of philosophy, numerous philosophers have thought about inconsistency. This section of the thesis highlights only a few philosophers who had important thoughts on inconsistency and contradiction. These philosophers were chosen due to offering something novel about inconsistency and not following the *status quo*. Beginning in the modern period, both Arnauld with Nicole (1996), and Descartes (1984a, 1984b & 2012) put forth interesting thoughts on contradiction with respect to testimony and God's omnipotence. Next, the late eighteenth and early nineteenth-century philosopher Hegel's dialectical philosophy (2010) was one of the few to make contradiction the centre of his dialectical historicist philosophy. His influence extended to Marx ‘s dialectical philosophy (Cooper 1925) and others including contemporary paraconsistent philosophers Priest and Routley (Sylvan) (1989). In the nineteenth and early twentieth century, the existentialists, including Kierkegaard (1986) and Camus (1955) thought that contradiction and inconsistency were a fact of human life. Ending in the contemporary period, Strawson (1952) carefully articulates an ordinary language understanding of inconsistency, and the Australian school of the paraconsistent logic of Priest and Routley (Sylvan) (1989), like Hegel (2010) before them, embrace contradiction but do so in a formal systematic manner through logical machinery.

1.5.1 Arnauld and Nicole

Arnauld with Nicole (1996) were early modern philosophers whose most famous philosophical creation is *The Art of Thinking.* This work is largely a reworking of Aristotle’s logical thoughts along with considerations about the relationship between religion and reasoning. In one of the later sections of the work, Arnauld and Nicole discuss the role and effectiveness of testimony and testing the veracity of what someone says. Arnauld and Nicole separate two types of circumstances, internal and external (Arnauld & Nicole 1996:264). Internal circumstances are those about the fact itself, such as if a miracle took place or not. External circumstances are those about what is said about the fact, such as whether to believe someone who says she has witnessed a miracle.

These circumstances lead to a “rule” – as Arnauld and Nicole characterise it – about the relationship between believing and the probability of the belief. If a belief has false circumstances surrounding it, we are led to believe that the improbability of that belief is true, given what we are told. If a belief has true circumstances surrounding it, we are led to believe that the probability of that belief is true, given what we are told. Normally, however, being probable or improbable is not enough to believe what we were told with assurance. However, Arnauld and Nicole (1996:265) want to qualify a proper use of probability and possibility:

> "There is, however, an exception to this rule, when we ought to be satisfied with possibility and probability. This is when a fact that is otherwise sufficiently confirmed is beset by difficulties and apparent contradictions with other stories. In that case, it is enough if the solutions brought to these contradictions are possible and likely. It is acting against reason to require positive evidence of them, because when the fact is sufficiently proved within itself, it is not right to require similar proof in all the circumstances."

What Arnauld and Nicole have in mind here is something like the following:

1. Story 1.
2. Story 1 strongly conflicts with Story 2.
3. Story 1 weakly conflicts with Story 3.
4. It can be shown that on (at least) one interpretation Story 1 and Story 2 can possibly be consistent.
5. It can be shown that on (at least) one interpretation Story 1 and Story 3 can possibly be consistent.
6. Proof of 4 and 5 is too high of a demand because there is proof for Story 1.
7. Thus, the testimony and circumstances of Story 1 are true (and can be believed).

Arnauld and Nicole (1996:265) articulate a proper use of contradiction in an ordinary circumstance. This is the very kind of thing that takes place in an investigation, whether criminal, civil, or even family-related. When competing stories conflict with a new one, and there is sufficient evidence for the new one, proof of the falsity of the competing stories does not need to be demonstrated. Instead, all that needs to be demonstrated is that the new story can be reconciled, in terms of possibility, in some sense with the competing stories. However, the contradictions do not demand one or the other be true or false, as classical logic desires. So, the behaviour of contradiction in ordinary life is much different than in classical logic.

1.5.2 Descartes

Descartes was an early modern philosopher who is most famous for his *Meditations on First Philosophy*. He was a contemporary of Arnauld and Nicole, and even dialogued with Arnauld.[16] Descartes was famous for his foundational epistemology and incorporating the philosophical aspects of his Roman Catholic faith into his philosophy. For example, the third (1984b:28–36) and fifth (1984b:43–49) *Meditations* both have arguments for the existence of God, and God's existence proves foundational for Descartes' philosophical purposes. In Meditation six (1984b:55–56), God's existence ultimately guarantees that the world is the way it is in our experience. More so, in the third *Meditation,* Descartes writes on the perfection of God and how our experience can be truthful. Descartes (1984b:35) writes:

> "By "God" I mean the very being the idea of whom is within me, that is, the possessor of all the perfections which I cannot grasp, but can somehow reach in my thought, who is subject to no defects whatsoever. It is clear enough from this he cannot be a deceiver since it is manifest by the natural light that all fraud and deception depend on some defect."

By having a clear and distinct perception, we are perceiving as God wants us to, by necessity. One clear and distinct perception we have, is of God. For Descartes, the veracity of this perception of God cannot be questioned; it is incorrigible. Our perception of God is also that God is perfect. Perfections for Descartes include being the following: eternal, infinite, immutable, omniscient, omnipotent, and Creator of all things that exist outside of Himself (Descartes 1984b: 28).

Given Descartes' conception of a perfect God, the following thoughts on God and contradiction are radical, not just for Descartes but for virtually anyone. Descartes (2012:168–169), in his 1644 *Letter to Mesland*, writes:

> "I turn to the difficulty of conceiving how God has been free—with no pull either for or against—to make it false that the three angles of a triangle are equal to two right angles, or in general to make it the case that some pair of contradictories are both true. It's easy to dispel this difficulty by considering that (i) God's power can't have any limits, and that (ii) our mind is finite and created in such a way that it can conceive as possible the things God has wanted to be in fact possible, but cannot

[16] See Descartes' Objection Four (1984b:138–153).

> conceive as possible things that God could have made possible but has wanted to make impossible. From (i) we learn that nothing could make God make it true that contradictories can't be true together, and therefore that he could have done the opposite, i.e. made it false that contradictories can't be true together. From (ii) we learn that even though this is true, we should not try to comprehend it because our nature is incapable of doing so."[17]

This surprising quote details that, for Descartes, God is without the traditional logical limits that Scripture and theologians place on God.[18] Descartes clearly demarcates that what is possible with God is different from our perceptions of what God can and cannot do. Humans place a logical limit on God's power, whereas God has no such limit, according to Descartes. The interesting implication of this view is not obvious unless you consider both quotes from Descartes: a perfect God could be a God that makes contradictions true. While it would be too strong of an implication to think that God's own being could be contradictory, there appears to be no logical restriction on being in this sense, unless God self-restricts.

However, Descartes is a philosopher who prizes consistency. In the *Meditations*, Descartes arrives at the *Cogito* as the one thing not suspect to doubt (1984b:19).[19] To doubt that one is a thinking thing requires thinking itself, thus, is a performative contradiction (1984b:19). In this sense, Descartes uses "contradiction" in the classical way as something that is metaphysically impossible, or impossible to perform.

The implication is that Descartes has at least two views of contradiction, one that is beyond our comprehension if a contradiction involves God, and another that contradiction is more along the lines of the classical one as something to be avoided. Logical limits are placed on humans that are not placed on God. Nevertheless, humans operate within a particular sphere and the second sense of contradiction is operative for us, arguably as a measure of intelligibility.

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[17] Given the controversial nature of the assertion about Descartes, the original quote at length was presented.

[18] From the Bible, Malachi 3:6 and James 1:17 both limit God's ability to change for instance. Clark (1980:6) states that God is logic and to violate the law of non-contradiction is a sin. Van Til (1974:11–12) holds a similar view as the law of non-contradiction is part of God's internal nature.

[19] Technically as the *Cogito* is taught – "I think, therefore I am" – is found to be directly in the *Principles of Philosophy* (1984a:196) but the paraphrased concept is in the *Meditations*.

Contradicting oneself at the same time and same sense has little use for one's communicative and educational practices.

1.5.3 Hegel

Hegel was a German idealist who followed the modern period. Hegel and other idealists such as Fichte had the unenviable task of following Kant in the chronological progression of philosophy. Kant's critical philosophy set the stage for the years of immediate responses, of which Hegel's work may be considered a contribution, too.[20]

As with Kant's philosophy, Hegel's is equally difficult, if not even more so, because of the abstractness and language used to convey his ideas. However, Hegel's philosophy is unique. It utilises contradiction in a way that few had, and few have since. To tackle this task of fully explaining his view of contradiction is beyond the scope of this thesis but a simplified view is in order.

Hegel's three main works were the *Philosophy of Right* (1967), the *Phenomenology of the Spirit* (1976), and the *Science of Logic* (1969 & 2010). This last work is the source for his detailed use of contradiction and his variations of it. One variation from the section on contradiction is:

> "As this whole, each moment is self-mediated *through its other* and *contains* this other. But it is also self-mediated through *the non-being of its other* and is, therefore, a unity existing for itself and *excluding* the other *from* itself" (Hegel 2010:374).

Hegel's view on contradiction can be expressed and drawn from the content of this passage. The traditional view on contradiction is that *A* excludes *not A* and *not A* excludes *A*. This exclusionary view of contradiction goes back to, at least, Aristotle. Hegel adds another element to this in that contradiction is also inclusionary. In the concept of *A*, *A* and *not A* are exclusive, but to understand *A*,

[20] Kant likened his philosophy as the Copernican turn in philosophy for his synthesis of rationalism and empiricism (1998:110). His emphasis on synthetic *a priori* knowledge, transcendental idealism, and the active role of the mind set his philosophy apart from his contemporaries and became the object of philosophers after him and still today (Rohlf 2016).

not A must be understood too, and vice-versa. This contrastive understanding is inclusionary, as the opposition creates an additional meaning of the concepts together. This additional meaning is something new, *additive,* and is active and dynamic. The exclusionary and inclusionary aspect of contradiction forms the basis for Hegel's use of the dialectical method of thesis-antithesis-synthesis, with the synthesis being the additive component. This abstract explanation of contradiction can be difficult to understand in application. So, we turn to some practical thoughts on contradiction from Hegel (2010:382):

> "But ordinary experience itself testifies that *there do exist* at least *a great many* contradictory things, contradictory dispositions, etc., of which the contradiction is present not in any external reflection but right in *them*. Nor is contradiction to be taken as an abnormality which happens only here and there ... External, sensuous motion is itself contradiction's immediate existence. Something moves, not because now it is here and there at another now, but because in one and the same now it is here and not here; because in this here it is and is not at the same time…"

This passage contains many ideas, but the import is the practical application of the concept of contradiction. For Hegel, contradictions exist and are part of reality. This is a strong break from any philosophical tradition that reality itself is consistent in an important sense. Consistency and intelligibility, at least in an ordinary sense, are necessary for understanding reality even if contemporary science tells us something different.[21] Hegel's conception of human experience is different, however, as he sees contradictions in our ordinary experience. Human motion is the paradigm of contradiction. Take, for instance, at the same time and place someone is both in and not in a doorway; Hegel (2010:382) writes:

> "Something moves, not because now it is here and there at another now, but because in one and the same now it is here and not here; because in this here it is and is not at the same time … contradiction is *existent*."

This action is a normal everyday activity that we all do numerous times in a day. In this sense, we are living contradictions for Hegel.

[21] Modern quantum mechanics challenges this consistency view. See Gibbins (1987), *Particles and paradoxes: the limits of quantum logic* for more details.

Hegel’s views on logical principles put contradiction, not identity, as the essential logical concept. Hegel (2010:381) claims:

> “… if order of preference were an issue, and the two determinations were to be held separate, it would be the principle of contradiction that should be taken as the more profound and the more essential … identity is only the determination of simple immediacy, of inert being, whereas contradiction is the root of all movement and life…”

Hegel believes that identity is a dead concept. Two equivalent things display nothing in terms of living behaviour. They are simply equivalent. For Hegel, contradiction is the motion of life, thus, it is more important conceptually, as it articulates the human experience as dynamic and subject to change.

Before moving on to a brief critical assessment of Hegel’s thoughts on contradiction, a few positive implications need to be drawn out. Hegel’s bold thoughts on contradiction are inspiring, especially considering classical logic and its negative connotations of contradiction. This rejection of classical ideas about contradiction is historically and philosophically significant because of its challenge to the philosophical and logical canon. More so, Hegel’s dialectic has, at its core, a synthesis of opposing ideas that become a new idea. One can argue that contradiction forms the core of this influential idea, which demonstrates a systematic approach to contradiction inclusion in a theory. Instead of avoiding contradiction, Hegel embraces it (2010:381).

There are three critical implications to draw from Hegel’s work. First, Hegel’s relationship between language and the world needs to be questioned, for the way in which language explains something and the structure of physical reality can be two different things. Where Hegel articulates contradictions in reality, it does not necessarily entail that there *are* contradictions in physical reality. An analogy with infinite numbers might be helpful. There are infinite numbers as mathematical constructions, such as transfinite cardinals. However, the postulation of transfinite cardinals does not entail that they exist somewhere in physical reality. Logical and mathematical constructions may be just that, and if so, Hegel has this relationship wrong.

This lack of correspondence between language and reality stands separately of Hegel’s articulation of contradiction, which leads to the second critical point. It is not clear that anything is “additive” to the contradiction as Hegel posits. “Additive” is a vague term, which may refer to truth-values – where the conjunction is added to true and false – or resolution is added to an idea and its negation. While in his overall metaphysical scheme the additive property conceptually fits that scheme, the scheme itself is subject to justification, too. There is little evidence that the scheme is true and an accurate representation of reality. What this implies is that when a metaphysical schema adds a “property” such as being “additive” and there is no way objectively to ascertain the relevance of that property, the value of the property is questionable. Occam’s razor – wherein metaphysical properties are not multiplied beyond what is needed for explanation – would eliminate this property in our physical reality.

Finally, if Frege is right (1980:116–118), identity is the most basic logical concept, not contradiction as *per* Hegel (2010:381). While it might be “inert” as Hegel claims, the concept of identity is enough to be the foundations for arithmetic. Even a contradiction must be identical with itself for it to be a “contradiction.” Thus, the priority of contradiction over identity is another example of Hegel’s systematic influence over concepts.

1.5.4 The existentialists

Existentialism, as a philosophical movement, reached its peak in the mid-20th century. Iconic figures such as De Beauvoir, Sartre, and Camus all flourished and championed the individual and their struggle with living an authentic life. Historically, existentialism likely originated with Kierkegaard (Burnham & Papandreopoulos 2018). Kierkegaard is an interesting place to start because he was a theist and a Christian, whereas most existentialists were not. Regardless, what the existentialists share is an attempt to make sense of life in a world that does not always make sense. This irrationality of the world leads straight to paradoxes and inconsistency. To see this in two different contexts, we look to Kierkegaard for a theistic one and then Camus for an atheistic one.

1.5.4.1 Kierkegaard

Kierkegaard's religious background created intellectual and emotional conflicts that he sought to resolve (McDonald 2017). He labelled many of these "paradoxes", for instance in the *Philosophical Fragments* (1936:46) he writes about the supreme paradox of all thought that humankind engages in:

> "The supreme paradox of all thought is the attempt to discover something that thought cannot think. This passion is at bottom present in all thinking, even in the thinking of the individual, in so far as in thinking he participates in something transcending himself. But habit dulls our sensibilities, and prevents us from perceiving it."

In his famous work *Fear and Trembling* (1986), Kierkegaard thinks through the Abraham and Isaac story from Genesis 22, where God calls upon Abraham to sacrifice his son, Isaac. The story Kierkegaard tells in the *Problemata* is one of anguish (1986). How can God ask him to do this when he has waited so long for a son? How can his love for God and his son be tested at the same time? For Abraham, he is being asked to sacrifice his son to God, yet, society will see him as a murderer. How can this one act be looked upon in so many conflicting ways? Simply, it is a tale of irrationality and one of a man's anguish.

In the *Philosophical Fragments* (1936:51), Kierkegaard takes issue with Hegel's thoughts on contradiction. He writes:

> "The word 'contradiction' must not here be taken in the frothy sense into which Hegel has beguiled himself and others and the concept– that it has the power to produce something. As long as nothing has come into existence, the contradiction is merely the impulsive power in the passion of wonder, its nisus; but it is not the nisus of the process of coming into existence itself."

Kierkegaard is directly challenging Hegel's idea (2010:374) that contradiction is additive, that is, that it produces something new. Instead, Kierkegaard gives contradiction a certain kind of power in the passion it produces, and a sense of wonder (1936:51). This understanding of contradiction is insightful, as it articulates one of the functions of contradiction. It can produce a feeling in someone, yet, be part of the experience of the contradiction, not something new. What if the purpose of a contradiction is merely to produce astonishment and puzzlement to require a critical reflection of what is occurring? It seems that this is how Kierkegaard uses contradiction and paradox in his writings.

Additionally, from the *Philosophical Fragments* (1936:25), Kierkegaard questions how human beings can know God. However, it is not that simple because God is unlike human beings, and this makes any relationship between the two tenuous. Another contradiction is revealed. Kierkegaard (1936:25) opines:

> “From this, there would seem to follow the further consequence, that if man is to receive any true knowledge about the Unknown (the God) he must be made to know that it is unlike him, absolutely unlike him. This knowledge the Reason cannot possibly obtain of itself; we have already seen that this would be a self-contradiction. It will, therefore, have to obtain this knowledge from the God. But even if it obtains such knowledge it cannot understand it, and thus is quite unable to possess such knowledge. For how should the Reason be able to understand what is absolutely different from itself?”

To know God, the believer must realise that he or she is completely unlike God, but that is a gap that seems to be both bridged and not bridged in some sense. The believer is left knowing that there is a God, but knowing nothing about that God. That lack of knowledge occurs because God gave the believer only a limited amount of knowledge that God is wholly different. However, reason is unable to obtain this knowledge of God because reason tells us that reason is the measure of all things. If reason by some chance obtains knowledge of God, it is incapable of understanding it. This articulation strains comprehending God because humans cannot rely on reason to make sense of it. The implication is that the believer both knows and does not know God, an apparent contradiction.

The practical consequence of Kierkegaard’s understanding of contradiction is that he has two views. There is the one view of contradiction that cannot make sense of God, which turns someone toward faith because reason is impotent. The incarnation of Jesus Christ is another example: fully God and fully man. Reason tells us that is not possible. The second view of contradiction might be a reaction to Hegel (2010:374), where the individual is pitted against the collective, but the individual is always part of the collective in some sense, so there might be a divine contradiction as in the first case and a secular version in the reaction to Hegel.

1.5.4.2 Camus

Albert Camus was a Nobel prize winning author and existentialist philosopher. His notable books include: *The Myth of Sisyphus* (1955), *The Stranger* (1989), *The Fall* (2012b*),* and *The Rebel* (2012c). In these works, Camus develops the concept of an absurd hero. This is not just any hero. It is a hero who struggles against the absurdity of life daily. These heroes live contradictory lives as Camus details. For instance, in *The Stranger* (1989), Meursault only starts living once he knows his death is imminent. The same can be said for the Mersault character of the *Happy Death* (2012a).[22] To live is to die.

The Myth of Sisyphus (1955) is Camus' philosophical treatise focusing on suicide. While Camus gives no formal definition of "contradiction", he provides many examples and insight into the concept. An ordinary understanding of Camus' general point is that for most people, life goes on with no problems. However, for some, along the way they are confronted with a life changing event. This event does not make sense, but it changes the way the person looks at the world. The world is no longer a rationally ordered place. Instead, it is one of irrationality or the absurd. However, some are driven by this absurdity to suicide as an answer to life's meaning. Hence, Camus investigates how the absurd and suicide relate to life's meaning.[23] Camus (1955:6) writes:

> "On the other hand, it often happens that those who commit suicide were assured of the meaning of life. These contradictions are constant. It may even be said that they have never been so keen as on this point where, on the contrary, logic seems so desirable."

Camus thinks some people who commit suicide in one sense are certain life has no meaning, but in that recognition the meaning of life is certain—it has no meaning. A blatant contradiction, or as Camus believes, a moment of the absurd. Life, for the person who sees the world in this way, is irrational and contradictory.

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[22] The spelling of "Mersault" is on purpose as the character differs from the one in *The Stranger* (1989).

[23] A helpful definition of "the absurd" comes from Thomas Nagel's paper, *The absurd* (1971: 719–721): paraphrasing Camus, Nagel proposes that the absurd is when the world fails to meet our demands for human meaning and a conflict based on self-consciousness arises in ourselves.

Moments like these come throughout life but are not necessarily tied to suicide. They are moments where the absurd grips the person. Camus (1955:11) says: “Likewise the stranger who at certain seconds comes to meet us in a mirror, the familiar and yet alarming brother we encounter in our own photographs is also the absurd.” Of anyone in the world, a person should recognise oneself in a picture. However, for that fleeting moment the question arises, who is that person? That is a moment of the absurd for Camus, and a contradictory moment; a person both knows and does not know oneself. Camus, like others, sees human experience as having contradictions largely generated by the absurd.

Unlike Kierkegaard, Camus is an atheist. Whereas Kierkegaard ultimately has a ground for the world to be a particular way in God, Camus does not. In *The Myth of Sisyphus,* he writes (1955:78): “This universe henceforth without a master seems to him neither sterile nor futile.” Human beings are the masters of their own domain. While contradictions and paradoxes may be resolved for Kierkegaard (1936:25) through God, Camus has no such hope. His hope is in humankind and not giving into the absurd or letting contradictions end one’s existence through giving in to the absurd.

1.5.5 Analytic philosophy

The analytic philosophy movement was one of two main movements in the 20th century, the other being continental philosophy. The analytic movement had two distinct veins: natural language philosophy and ideal language philosophy (Beaney 2017). The early part of the century saw a heavy influence of the latter, mainly manifesting in the logical positivists and empiricists, and later in Quine. They were strongly influenced by science and the use of formal logic to solve philosophical problems. The former was represented by: Wittgenstein, Ryle, Austin, and Strawson. They tended to be common sense-based and thought the problems of philosophy were the result of the misuse of ordinary language.

1.5.5.1 Strawson

Strawson was an influential analytic philosopher in the last century. His work included an interpretation of *The Critique of Pure Reason by Immanuel Kant* which he called *The Bounds of Sense* (1975). He also wrote about the role of free will in *Freedom and Resentment* (1974), personhood in *Individuals* (1964), and extensively on the philosophy of logic (1952). In particular, his *Introduction to Logical Theory* lays out a formal system along with relevant thoughts about the relationship between ordinary language and formal logic (1952). He begins this work by writing about inconsistency in detail in both respects.

Strawson (1952:15) uses the linguistic distinction of first-order and second-order languages. Ordinary language is first-order; formal logic is second-order. His point is that we construct the ideal of a formal language from an ordinary language (1952:15). In one sense, formal logic is a caricature of logic in ordinary language because it simplifies and minimises the relationships between ideas without the subtleties of ordinary language, particularly in context and use.

For Strawson, inconsistency in ordinary language is truth-value based. Inconsistent claims carry opposite truth-values.[24] “Scott is in California” and “Scott is not in California” carry opposite truth-values; when one is true, the other is false and vice-versa. For Strawson then, “true” and “false” are first-order concepts. When constructing a formal second-order language, these concepts are carried over from the first-order ordinary language to the second-order language, and then applied in a different context. The question then arises, do the concepts of “true” and “false” have the same meaning in both languages?

Contra Strawson, these concepts do not retain the same meaning. Typically, “true” and “false” in ordinary language refer to the world through correspondence, or known analytic truths, such as 2 + 2 = 4. In the second-order language, “true” and “false” are just binary oppositions, related to the defined truth

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[24] Strawson (1952) does articulate the notion of predicates that conflict, which would be a first-order conflict. When logic is brought to bear, albeit incompletely for Strawson, truth-values conflict (1952:66–69).

functions of the logical connectives. They do not reference the world in the same way the ordinary language words do. The context of ordinary language substantiates a different meaning from the formal language meaning. This difference is important, because even if a first-order judgement is made about the truth and falsity of a statement, it is not the same in meaning as the logical assessment of the second-order statement or logical construction.

Strawson writes at length about contradiction proper, providing more than a few examples and definitions. Two of these are the focus here. Strawson (1952:3) says: “Contradicting oneself is like writing something down and then erasing it, or putting a line through it.” This ordinary explanation reveals what we normally take to be problematic about contradiction; it simultaneously gives and it takes away. However, in this instance, contradicting oneself is part of an action that occurs in human life. In the case of a blatant contradiction, Strawson is correct. It does not make a great deal of sense when done.

Linguistically, for Strawson (1952:17), contradiction is about the incompatibility of predicates, “… where one statement is inconsistent with another because it explicitly rejects (withholds, excludes) the predicate which the other applies …” In ordinary language, “not” functions as a rejection of the application of a predicate. When a statement and its negation are joined together, the result is the predicating of a property and rejecting that predication at the same time. Strawson makes an interesting point in that if a conflicting statement is incompatible with another statement, it is not necessarily contradictory. For instance, if a car is both red and black, it is part red and part black, and there is no point that it is both red and black. However, that conflict is not contradictory, as the contradictory statement would be it is not the case that the car is both red and black. Thus, predicates may conflict without being contradictory for Strawson (1952:17–18).

1.5.5.2 Paraconsistency

The late 19th and 20th century brought about a logical revolution of sorts—a new emphasis on formalism and formal methods in philosophy. Frege’s

Foundations of Arithmetic (1980), Whitehead and Russell's *Principia Mathematica* (2011), Wittgenstein's *Tractatus Logico-Philosophicus* (2001) and others such as Tarski's *The Semantic Conception of Truth and the Foundation of Semantics* (1944) made logical discoveries. The complexion of logic changed from an Aristotelian one to a multi-varied one based on particular logical needs, for instance, in recent times the development of modal logic (see Cresswell and Hughes [1996]), relevance logics (see Routley, Brady, Plumwood, and Meyer [2003]), and belief logics (see Hintikka [2005]). However, almost exclusively, these foundational authors cherished consistency, with its role in formal logic never really having been challenged. In fact, Russell sought to resolve his own paradox to remain logically consistent through his introduction of a hierarchy of types (1908).

However, in the late 20th century, the last domain of logic was attacked and criticised: consistency. From a formal logical sense, paraconsistency is a group of logics that are tolerant of inconsistencies. Two predominant paraconsistent schools arose: the South American school with Asenjo (1965) and De Costa (1974), and the Australian school of Priest and Routley (Sylvan) (1989). While they share many similarities, the latter school took paraconsistency into a new direction, *dialetheism*, or the view that there are true contradictions.

1.5.5.2.1 Priest and Routley (Sylvan)

Two philosophers were the major impetus for the paraconsistent movement in the English-speaking world: Richard Routley (Sylvan) and Graham Priest. They reject the *status quo* in logic and put forth a rigorous philosophical defence of the justification of inconsistency, in particular, inconsistent formal logics (1989:Ch.1). Whereas Strawson (1952) primarily looks at the significance of inconsistency in ordinary language, the paraconsistent logicians recognise that importance, too, but develop a formal logic to handle the purported inconsistencies in ordinary language such as the semantic paradoxes.

Paraconsistent logics typically reject two general inference principles: *ex falso quodlibet* and *ex contradictione quodlibet* (Priest, Routley [Sylvan] and

Norman 1989:141–142). The first is a rejection of a semantic principle that not everything follows from the false. In propositional logic, there is no constraint on inference from the false to the true or the false to the false, so anything follows from the false. If a contradiction is false, then this principle must be rejected. The second is a rejection of a syntactic principle, namely that not everything follows from a contradiction. In propositional logic using inference rules, starting with a contradiction, one can simplify into each component A, ~A. By the rule of addition, B can be added to A, (A V B) for A or B. When (A V B) and ~A are premises, using the inference rule disjunctive syllogism, results in B as a conclusion. So, from A and ~A, B was inferred. There is no relevance of the premises to the conclusion in this case, and effectively B becomes anything at all. So, anything follows from a contradiction, and the result is trivial. This principle must be rejected, along with disjunctive syllogism in an inconsistency tolerant logic because not everything is going to follow from a contradiction.

The rationale for this inconsistency tolerant logic is found in our own practices and language (Priest, Routley [Sylvan], and Norman 1989:483–528). Formal logic and language should mirror each other on this account. The semantic paradoxes, in particular, the liar paradox, are read by the strong paraconsistent logician as both true and false, a contradiction syntactically and false semantically.[25] If it is a contradiction and false, then anything should follow, and ultimately ordinary language should be trivial. However, it is not. Ordinary language is perfectly intelligible, showing that the inconsistency generated by self-referential paradoxes is not systematically problematic. The inconsistency is contained in some sense, and ordinary language does not suffer the illogical effects.

The strong view of paraconsistency makes a much bolder claim. “Dialetheism” states that there are true (and false) contradictions, and maybe there are even in the world (much like Hegel). Priest and Routley (Sylvan) reference Hegel’s take on motion being a contradiction as a true contradiction:

[25] A weak paraconsistent logician does not have to embrace the idea that triviality is blocked. She can maintain it is inconsistent as a feature of language, but is not true.

“Hegel’s philosophy was explicitly inconsistent…Hegel’s logic was paraconsistent” (1989:496). The debt to Hegel here is obvious. For a dialetheist, the real-world and logical world are contradictory worlds. While this view might seem outlandish, Priest draws upon quantum mechanics and mathematical examples (naïve set theory and the infinitesimal calculus), to justify his point (1989:483–500).

The paraconsistent logician uses formal means, like those in the earlier part of the 20th century to handle the logical implications of contradictions. The upshot of their work and research is that inconsistencies are containable and do not necessarily cause systematic disintegration. An inconsistency tolerant logic is not a logic where everything goes——in fact, it can be quite conservative. This outlook on inconsistency is not only helpful but mature as the world and human lives are not always consistent in the way classical logic would have us believe.

The downside of paraconsistency is evident; one must give up classical logic. Given the role of classical logic in the philosophical canon, doing so is anathema. However, the practical import is that education about inconsistency would need to be changed to accommodate the general idea that inconsistency is not pernicious in all cases. This change would require a revision of pedagogy and a change in the normally negative attitude toward inconsistency. One of the main reasons for pursing this thesis is to correct the normally univocal negative attitude toward inconsistency. Semantic inconsistency can be a problem, but it is not problematic in all cases and may even be helpful in others.

1.6 Synthesis and analysis

This chapter has presented many different thoughts on inconsistency, with minimal analysis of each view. The purpose of this section is to analyse the similarities and differences of the various thoughts to demonstrate that inconsistency is not a univocal concept. But first, a few general thoughts on the history of philosophy and inconsistency.

The beginning sections of this chapter put forth the thoughts of Heraclitus and Protagoras. The conclusion reached in both instances was that a proper understanding demonstrated that there were no substantive inconsistencies in either. A charge of inconsistency is one of the most substantive charges made in philosophy and should not be done lightly. This charge also has the consequence that the inconsistency is theory defeating, such that if true, Heraclitus' and Protagoras' philosophies are undermined, and are probably worth a lesser value than a consistent theory (supposing there is one). The harm done to these philosophers for generations is uncharitable at best, demeaning at worst. These philosophers become targets of the strawman fallacy, where their positions are not really what they held. The moral of Heraclitus and Protagoras is that a charge of inconsistency takes on a historical life of its own, regardless of its truth.

The five types of inconsistency: metaphysical, psychological, communicative, logical and linguistic serve to classify some of the similarities and differences in this chapter. While these categories are not exhaustive, they further demonstrate that just by classification inconsistency comes in many forms, not just ones that are truth-value related. Each of these will be taken in turn.

Metaphysical inconsistency has Aristotle as its main defender due to his essentialism and the way reality is for him. Physical contradictions cannot occur in reality. Hegel, contrastively, argues that they do occur and in fact, are fundamental to experience. Aristotle would reject the "additive" conception of contradiction because contradiction adds nothing to experience as Hegel believes. The underlying presumption is that reality is consistent for Aristotle but not for Hegel. This is important to note, because modern quantum interpretations would be much friendlier to Hegel given their inconsistency, such as the status of a particle or a wave, or the state of Schrödinger's cat. Another strong metaphysical view of inconsistency comes from dialetheism, such that there can be true contradictions in the world. This view has affinities with Hegel and would be subject to the same conflict with Aristotle's views. The polarity between views manifests strongly in the metaphysical conception.

Aristotle's psychological conception of inconsistency gives food for thought and is not as easily classified as the previous concept as it bleeds over to the communicative type as well. Descartes, for instance, holds to some form of psychological inconsistency between his views of God and the *Cogito*. God is not subject to contradictions but humankind is subject to them in the application of thought. The *Cogito* itself may be a metaphysical contradiction if we take it as one thinks they cannot think in the process of thinking. Kierkegaard is psychologically inconsistent too with his discussion of the story of Abraham, murder and/or sacrifice of Isaac. One similarity between them is that neither let the concept of inconsistency scare them away from embracing inconsistency as an explanation. That embrace is to their credit, but is surprising for Descartes given his rationalist and mathematical background where inconsistency and outright contradictions are avoided. But it is not so surprising for Kierkegaard with his irrational, existentialist philosophy.

Camus, like his existentialist counterpart Kierkegaard, uses inconsistency to generate the tension of an absurd life. Since the world is what it is, the conception of the world as irrational involves beliefs of how it should be and how it is. The conflict between those, results in psychological inconsistency. Camus furthers his inconsistency with the specific tension between meaning and terminating that meaning through suicide. If someone commits suicide, one is rationally assured that life is not worth living, yet reason yields a different answer, namely that consciousness is terminated and that the world is irrational. The concepts of 'rational' and 'irrational' chase each other showing their psychological dependence on one another for explanation.

Lastly, Arnauld and Nicole share a psychological conception of inconsistency and uphold, to some degree, Aristotle's thoughts on having conflicting beliefs about external events. When accounts of something in reality differ, other beliefs factor in to fill in the context and help determine which account to believe. *Contra* Aristotle, conflict is not necessarily inconsistent in any keen sense, as accounts are more or less probable and that difference in probability generates the conflict. Interestingly though, this idea is also found in Aristotle in terms of gradations of belief, but without explicit truth-value or truth talk.

The communicative sense of inconsistency owes its roots to Aristotle, too, as avoiding inconsistency in what we assert is needed for basic intelligibility and discourse. Descartes, engaged in the communicative sense with the idea of a performative contradiction. This is to deny thought and express that denial, such as by arguing that, “I cannot write a sentence in English.” Practically, the communicative sense is the most obvious sense of inconsistency in everyday life and is a source of conflict. In fairness, Aristotle’s practical rationale of contradiction avoidance for communicative intelligibility should be understood as a normative principle in daily life. The felicities of communication are not so easily surrendered as are the logical or psychological senses of inconsistency. Using language correctly aids agreement and promotes understanding but with glaring inconsistencies neither of them come through strongly.

Aristotle still stands as the foundation for the logical conception of inconsistency and contradiction. Strawson agrees with Aristotle’s basic formulation in terms of truth-values, as an example of a contemporary classical logician. Priest and Routley (Sylvan) would disagree, showing the concept of contradiction impotent when adopting a paraconsistent logic and ultimately rejecting the traditional meanings of truth-values. It is important to note that the logical issues that Priest and Routley (Sylvan) are interested in exploring, can be divorced from communicative and psychological conceptions of inconsistency.

The paradoxes of material implication demonstrate a conflict between propositional logic and semantics. The general conflict comes from the meaning of a logical connective versus that meaning in natural language. Truth-values, not semantic relations between propositions, undermine the relevance of an antecedent in a conditional to a consequent in the same conditional. Furthermore, while not a direct agreement with or a problem for Aristotle, the systematic issue is a logical one. Given propositional truth tables and the results they produce, for example, from a material conditional where there is false antecedent and a false consequent, the result of the material conditional is a true value. This calculated truth-value is foreign to conditional usages in natural language and shows an inconsistency in what the formal system produces as a result and what natural language reasoning would produce as a result in the same context.

With the advent of non-standard logics, in one sense, Priest and Routley (Sylvan) are changing the context. To be fair to Aristotle, he was working in a different paradigm, and comparing their views might be the proverbial case of "apples versus oranges". Historically, Aristotle's thoughts are still dominant over any of the non-standard logics and their posits about inconsistency and contradiction. Whether that dominance is due to reflective thought or authority is up for debate, however, authority plays a strong role in the history of logic.

The final area of inconsistency are the linguistic considerations of semantic conflict. Strawson, for instance, writes of predicates conflicting as a source of inconsistency. One way this happens is through negation proper, "Sia is here" and "Sia is not here." Another way is by noticing the extension of the predicate, where "Sean is a man" and "Sean is a woman" conflict through predicate extension to a group, but not through negation use–this has interesting consequences in chapter four. Arnauld does something similar by noticing semantic conflict in stories, where "Bill arrived late" and "Bill arrived on time" conflict without negating claims that are exhaustive. Arnauld and Nicole likely had a coherence element to their account where internal and external circumstances should cohere as part of a story, and that coherence itself may stand as another generalised source of inconsistency. The story must make sense of both the fact itself and the testimony about that fact to cohere. Coherence is set up against the coherence of another story, which generates linguistic conflict at a higher-level than merely internal to the story.

In both Heraclitus and Protagoras there is an appearance of semantic conflict, but it is a surface one. This is to be distinguished from Strawson's and Arnauld's ideas, which have much more traction semantically as expressing some form of legitimate conflict. This appearance/legitimate distinction is important for this thesis as it becomes the impetus for a theory of legitimate semantic conflict as inconsistency claims in chapter four

1.7 Concluding thoughts

In this literature review, a brief history of inconsistency was provided. The research question was posed: *what does the history of philosophy show us about the concept of inconsistency?* The answer is multifaceted. Some attributions of inconsistency were found to be questionable and others were not. Some philosophers embrace inconsistency, and others do not. However, when thinking about inconsistency, it is apparent that it is not a straightforward univocal concept outside of it being a conflict of sorts. What conflicts may be include speech acts, symbols, predicates, definitions, and other elements of human experience. It is important to understand that at its core, inconsistency is contrasted with consistency in the appropriate context. These concepts work together. It is also important to understand that some do not view inconsistency as particularly problematic in the way that others do. It is not that inconsistency is desirable over and above consistency, but it does not necessarily need to have a negative connotation either. Contradiction and inconsistency can function as part of everyday life, showing amazement or even that something might be wrong, or needs further explanation. In fairness, this chapter has demonstrated that inconsistency is a multifaceted concept, which requires elucidation not only in a theoretical manner, but in practical, everyday reasoning, which is the focus of this thesis.

Chapter 2: Propositional deductive logic

2.1 Introduction

This chapter presents a system of propositional logic for the purposes of analysis and criticism in later chapters. First, however, the general notion of a formal language is articulated and contrasted with natural language. Elements of a formal language are discussed. From there both the semantics and syntax of propositional logic are detailed. Finally, the role of inconsistency in propositional logic and how the logical system manages it, are explicated.

2.2 Formal systems, logical systems, and languages

Formal systems are abstract ways of presenting and organising ideas. Mathematics and computer languages are two examples. Typically, they involve symbols, rules, and inference/implication to achieve a purpose or a result. One mark of a formal system is that it needs no interpretation; the system stands alone (Hunter 1996:4). Logical systems are formal systems; by definition, they involve symbols, particular rules of inference/implication or interpretations, and a purpose or a result. Formal languages, which are part of formal systems, are constructed for purposes such as computer programming (e.g. assembly language). A formal logical language is part of a logical system with its precise meanings of rules, symbols, and legitimate patterns of inference or interpretations.[26]

[26] Strictly, according to Hunter (1996:4), a formal language does not have rules of inference. He defines a formal language as one that consists of symbols and rules to properly form formulas. Since we are concerned with a logical language, we include rules of inference. And for the purposes of this thesis, “inference” is a misnomer in a logical system; it should be “implication,” as in rules of implication. Implication is a “must” relation where beliefs about the relation are irrelevant to rule following and the symbolic transformation that must follow. Inference is a “might” relation where beliefs are relevant and serve to bring about the best conclusion but there is no necessity necessarily involved. See Harman (2002) for substantiation of this view of implication and inference.

Understanding formal and logical systems are critical for this thesis. On the surface, one may wonder why, though. They seem to have no obvious relationship to critical reasoning in everyday life. That intuition is understandable and articulates why it is necessary to explicate the ideas. Formal/logical systems underlie many ideas taught in some reasoning courses, especially those relying on Aristotelian and propositional logic. While they are rarely presented in a systematic manner, the system itself makes whatever is presented meaningful in a holistic sense. By having an understanding of formal/logical systems, further clarity ensues regarding the difference from ordinary, critical reasoning, which is not systematic in the same sense.

An artificial language contrasts with a natural language. Formal languages are artificial languages. A natural language is one that is the product of a living human, and is human in context of use and application. Languages such as English and Spanish are natural languages. Linguistically, natural languages are more complex than artificial languages with natural languages containing many subtleties of context and relative use. Artificial languages typically have one context. If there are any subtleties, these are systematic but not about application or use.

Strawson (1952:15–24) explained first-order and second-order languages in detail. Applying these concepts, natural language is a first-order language; artificial language is a second-order language. Ideas of language from the first-order need to be in place to model another language, a second-order language, that only contains limited conceptions of the first-order language. The construction of a second-order language is dependent on the first-order language, or an artificial language is dependent on a natural language. The direction of dependency is important in both, as meaning is drawn from the first-order or natural language and given to the second-order or artificial language.

Propositional deductive logic is a second-order artificial language. It draws its meaning from a first-order natural language, English. However, second-order meanings are different from first-order meanings in some cases. In short, the meanings of the two languages are not the same and create some of the confusion about propositional logic. Given that they are two different languages to some degree, this confusion should not be surprising.

In summary, propositional logic is a formal logical language that contains rules, symbols, interpretations, and transformations. Interpretations are the basis for the semantic theory of propositional logic. The semantic ideas of truth and falsity for propositions determine the validity of an argument. Transformations are the syntactic theory of propositional logic where determining the validity of an argument is not according to its truth conditions. Rather the validity is according to a proper application of transformation rules, where one set of propositions or premises transform into another, i.e. the conclusion.[27] Both the semantic and syntactic versions of proposition follow in detail.

2.3 Propositional deductive logic (semantic)

This section articulates the semantic side of propositional deductive logic. It covers a simplified system of propositional logic through the standard use of truth tables. Some additional theoretical ideas are included that are used to evaluate truth tables along with the formulation of arguments and their assessment.

2.3.1 System considerations, well-formed formulas, and translations

Flew (1984:117) writes that a formal system is an uninterpreted system of symbols consisting of at least four main elements: variables, connectives/operators, some form of punctuation, and rules. Symbols represent variables (e.g. lowercase letters such as p, q, r, s and uppercase letters P, Q, R, S). A variable may either represent something outside the system or represent itself based on its own unique shape. In the latter case, the symbol acts in a purely formal way through shape differences relative to other symbols in the system. Symbols must manifest a usage difference. Connectives and operators

[27] This assumes an argument with premises. However, in syntactic propositional logic it is possible to prove a premise-less argument as valid. This is a subtlety to the system that is not relevant to this material's explanation.

join the variables into some particular relationship or formula. Punctuation organises connectives, operators, and variables, especially when there are complex relationships or formulas. To this end, symbols such as parentheses and brackets limit the range of a connective or variable. Finally, rules govern the correct formation of variables, connectives, and punctuation. Rules may also prescribe symbol manipulations for the previous three elements. In other words, rules tell us what we can do with all the symbols in the system. They are what allow us to manipulate, and work in and with, the formal system.

It is possible to understand a formal system in a straightforward, non-technical manner. There are symbols and rules, and one can manipulate the symbols by applying rules, with a result in mind. There is nothing mysterious about the formal system at that level, akin as it is to mathematical education and its manipulations.[28]

Classical propositional logic is a formal logical system consisting of the four formal language elements. Variables function in the same way in classical propositional logic as they do in the basic formal language. The variables are merely distinguished by their shape and represent themselves. The variables have no properties but those they gain from their functional role in the formal system. There are one operator and three main connectives: "~" or tilde represents negation, "ɔ" or horseshoe represents the material conditional, "V" or wedge represents the disjunction, and "·" or dot represents the conjunction.[29] Each connective combines variables whereas the operator reverses truth-values. The correct combinatory methods of variables, connectives, operators, and punctuation are guided by formation rules. By bringing these logical components together into a proper formulation, the components become well-formed formulas (WFFs).

One understanding of WFFs comes from Gensler (2010:118–120). For Gensler, any capital letter is a WFF and so is its negation (e.g. if A is WFF, so is

[28] In mathematical education, algebra, calculus, and arithmetic are all formal systems that share this sort of manipulation of symbols, which is no different to formal logical systems.
[29] I am classifying negation as a logical operator, not as a connective.

~A). The result of joining two WFFs with a defined logical connective and enclosing the result with parentheses is a WFF too (e.g. [P V Q]). Consider the following, (G ɔ h) is not a WFF because the "h" is lowercase. Consider as well, (G ɔ H) V K) is not a WFF because – according to the rules – it lacks the same number of parentheses on the left and on the right, one on the left and two on the right.

Sentences in natural language translate into the language of propositional logic.[30] Upper case letters represent the sentence or sentence component if it is a complex sentence. By definition, a complex sentence is one that contains a logical connective. Consider the following sentence, "Bill is happy." That sentence has a truth-value. Basing the translation on the predicate, the result is "H." Suppose we add "Sam is sad" to the sentence in a conjunctive manner. Basing the translation on the predicates, the result is (S · H).[31] From these simple sentences, complex sentences are built with the addition of connectives, variables representing the natural language equivalent (if necessary), and parentheses. So, translation is a straightforward process if the logical form of the natural language is evident in the structure of the formal logical language.

2.3.2 Truth tables for the connectives

Truth tables are logical diagrams that represent the possible truth-value combinations for a WFF. In propositional or sentential logic there are two truth-values: true and false. Representing these two truth-values is practicable in any number of ways "T" for true, "F" for false, or the convention used in this thesis "1" for true and "0" for false. Consider the sentence, "Scott is tall", which translates as "T." That sentence is either true or false. The truth table for a single WFF demonstrates this binary structure:

[30] This is the contentious issue against which I will argue in this thesis but is offered here as the standard practice of translation.
[31] We are following the convention of Harry Gensler (2010:118–119). For every connective, a pair of parentheses is necessary to limit the scope of the connective(s).

T
0
1

Consider the negated version of the same sentence, “Scott is not tall,” which translates as ~T. The truth table for this negated sentence is:

T	~T
0	1
1	0

In the left column is the original value of “T” and on the right is the negated value of “~T”. Represented by the tilde, negation reverses the truth-value of a WFF. Thus, in the table there is a vertical, or column, reversal of truth-values under the WFF.

Adding a sentence to the previous one, “Bill is small” the resulting translation is “S.” Combining sentences with a conjunction, the sentences translate to (T · S). The truth conditions for the conjunction are:

S	T	(T · S)
0	0	0
0	1	0
1	0	0
1	1	1 ←

The truth conditions for the conjunction reduces to the following: the WFF is true only when both conjuncts are true. In all other cases, the conjunctive WFF is false. Determining this value involves reading the truth table for the conjunction from left to right with only the last row being true under the conjunction connective.

Keeping the same sentences in mind, but with a different connective, the disjunction, they translate from “Scott is tall or Bill is small” to the WFF, (T V S). The truth conditions for the disjunction are:

S	T	(T V S)
0	0	0
0	1	1
1	0	1
1	1	1

The truth conditions for the disjunction reduce to the following: the WFF is false only when both disjuncts are false; in all other cases it is true. Determining this value involves reading the truth table for the disjunction from left to right with only the first row being false under the disjunction connective.

Logically, there are two options with a disjunction. The exclusive disjunction logically reads as the WFF is true when one, but not both, of the disjuncts is true. The inclusive disjunction logically reads as the WFF is true when one or both disjuncts is true. The disjunction truth table in use is the inclusive disjunction, which is the last row being true under the (inclusive) disjunction connective, unlike an exclusive disjunction where the last row would be false.

The final connective is the material conditional. In natural language, conditional sentences are most commonly “if … then …” sentences. A conditional sentence in natural language, “If Scott is tall, then Bill is small” translates to (T ɔ S). The “T” is the “antecedent” and the “S” is the “consequent.” The truth table for the material conditional is:

S	T	(T ɔ S)
0	0	1
0	1	0
1	0	1
1	1	1

The truth conditions for the material conditional reduce to the following single condition: the overall material conditional WFF is false only when the antecedent variable is true, and the consequent variable is false; in all other cases it is true. Determining this involves reading the material conditional truth table from left to right with only the second row being false under the material conditional connective.

There are two other logically interesting elements of the material conditional truth table. When the antecedent variable is false – rows 1 and 3, regardless of the value of the consequent variable – the material conditional WFF is true. So, the truth-value of the consequent variable does not factor into the overall truth-value for the material conditional in this case. Additionally, when the consequent variable is true – rows 3 and 4 – the overall truth-value of the material conditional is true, irrespective of the truth-value of the antecedent variable. Thus, the truth-value of the antecedent variable does not factor into the overall truth-value for the material conditional in this final case.

Comparing the column under each logical connective, each logical connective has different truth conditions. These truth conditions are the definition of the logical connective in propositional logic. For instance, in natural language, “conjunction” means “true” when both conjuncts are true; in all other cases the conjunction is false. In propositional language, pointing to, and understanding, the truth-values under the “·” suffices as a definition and meaning of the connective.

The basic truth conditions for the logical connectives form the core of propositional logic. Further, WFFs come together by combining connectives and operators, along with parentheses. No matter how complex the WFF becomes, there is a final connective with definite truth conditions. Theoretically, there is no problem with a finite set of sentences in combination with logical connectives and determining the truth conditions for that combinatory sentence through a complex WFF. Practically, it might be difficult as the complexity of the WFF, and its number of variables, has an exponential 2^n function. But, given the time and resources, its logical determination is possible.

2.3.3 WFF evaluation: tautology, contingency, and contradiction

There are three different ways to evaluate a WFF with at least one logical connective: tautology, contingent, and contradiction. A tautology, or tautological WFF, by definition, has all true values under the main connective in the WFF. For example, using the material conditional:

P	(P ɔ P)
0	1
1	1

Using the truth table for the material conditional, when both values are false, the conditional is true, and when both values are true, the conditional is true. So regardless of the truth conditions, 0 or 1, the material conditional WFF with the same variables is always equal to 1. Tautologies are called “necessary truths” because they cannot be false under any interpretation.

A contingent WFF, by definition, has mixed truth-values under the main connective. There is no requirement or specific pattern of truth-values, just a combination of both true and false values. For example:

P	Q	~(Q ɔ P)
0	0	0
0	1	1
1	0	0
1	1	0

The WFF, ~(Q ɔ P), has mixed values under the final operator. The truth-values under the negation are contingent because they are dependent on the truth-values of the individual variables. Most WFFs in propositional logic are contingent.

Contradiction, or a contradictory WFF, by definition, has all false values under the main connective. For example, using the conjunction:

A	(A · ~A)
0	0
1	0

Conjunctions are false any time there is a 0 value in the variables. The first row, A=0 and the second row, ~A=0, so conjunction WFF is necessarily false. Like a tautology, the truth conditions for the variables do not matter, as the result under the WFF's main conjunction connective is the same – false – regardless of their value being true or false.

2.3.4 Argument evaluation: validity and invalidity

In the previous section, individual WFFs were evaluated according to three different concepts. These evaluations were based on the vertical set of truth-values under the main connective of a WFF. Validity and invalidity are two evaluative concepts for individual WFFs taken as a group or an argument. A valid argument, by definition, is one where if all the premises are true the conclusion must be true. By definition, an invalid argument is one where if all the premises are true, the conclusion is not (necessarily) true.

Consider the following argument, where (P ɔ Q) and P are the premises and Q is the conclusion:

Q	P	(P ɔ Q),	P	∴	Q
0	0	1	0		0
0	1	0	1		0
1	0	1	0		1
1	1	1	1		1

Typically, assessing an argument for invalidity comes first, and if it is not invalid, it is, by default, valid. The only possible rows that this argument can be invalid on are rows 1 and 2, as they have a 0 in the conclusion. However, each of the first two rows contains a 0 in a premise, so the argument is, by default, valid. However, not all arguments are valid, such as the following:

Q	P	(P ɔ Q),	~P	∴	~Q
0	0	1	1		1
0	1	0	0		1
1	0	1	1		0
1	1	1	0		0

The third row's truth-value assignment of 1 to the premises and a 0 to the conclusion show an invalid row. Only one row in the truth table is necessary for the argument to be invalid. What that one row displays, is a structural flaw in the argument such that the premises, when true, can lead to falsity, and this defies the necessity of the transfer of truth from the premises to a conclusion in a valid deductive argument.

Validity is a hypothetical test, "if …" which by definition means it only supposes the values of the premises are true, i.e. if all the premises are true, then the conclusion must be true. This test evaluates the structure of the argument. This structure is not obvious when doing truth tables or the semantic theory of propositional logic. When WFFs are listed in a truth table horizontally, without prior instruction one does not know which direction to read the table or which WFFs are the premises and which WFF is the conclusion. However, in the next section, this notion of structure will be much clearer as arguments are considered valid or invalid, not evaluated based on truth-values, but on a proper use of transformation rules and reaching the needed result.

2.4 Propositional deductive logic (syntactic)

The formal logical language for the syntactic version of propositional logic is the same as the semantic version. WFFs are formed in the same way. The general goal of propositional logic is to have valid deductive arguments. However, the similarities end there as "validity" means two different things. The goal of propositional deductive logic semantically is to preserve truth from the premises to the conclusion. The goal of syntactic propositional deductive logic is to prove the conclusion through proper transformation rule application. The difference is the former relies on the interpretative aspect of truth and falsity, whereas the latter does not.

2.4.1 Propositional proofs

In propositional logic, a proof is a finite set of WFFs that are in a series, where the final WFF follows from the previous WFFs through the proper application of transformation rules. The transformation rules are of two types: simplification rules and inference rules. Simplification rules operate on a single WFF and simplify it into its components. Inference rules take two WFFs and infer a third WFF from the previous two. Both types of rules are "transformation rules" because they change formulas into other formulas.[32] Presented below is each type of rule and instances thereof along with some extrasystematic rules for future consideration.

2.4.2 Simplification rules

Simplification rules reduce a WFF to its individual components. There are three examples of simplification rules, one for each connective.

Conjunction simplification starts with two conjunct WFFs and reduces the two conjuncts WFF down to one WFF, or the other WFF, or both WFFs. Here is an example:

[32] The propositional system presented here is Harry Gensler's (2010:118–173). Gensler uses the *reductio* proof method along with a small set of simplification and inference rules. Conditional proof is not the focus of his text, thus minimizing the WFF equivalencies needed and rules such as INTELIM rules for natural deduction that require two for each connective. Most importantly though, the *reductio* method has inconsistency at the heart of it, showing another use of contradiction and one that contrasts (by supposing the opposite) with our everyday reasoning practices in some contexts.

(A · ~A)

∴ A, ∴ ~A

AND is the label of this rule, for "and." The rule: bring down the exact WFF components that are inside the parentheses, use one, or both.

Negated disjunction simplification starts with two disjunct WFFs and reverses the value of the disjunct WFFs to their opposite value. Below are two examples to demonstrate the opposite value condition:

~(A V B)	~(~A V ~B)
∴ ~A, ∴ ~B	∴ A, ∴ B

NOR is the label for this rule, for "negated or." The rule: bring down the opposite of the component WFFs inside the parentheses, use one or both.

Negated material conditional simplification starts with an antecedent WFF and a consequent WFF and keeps the value of the antecedent WFF the same and reverses the value for the consequent WFF to its opposite. Below are two examples to display the opposite condition:

~(A ɔ B)	~(~A ɔ ~B)
∴ A, ∴ ~B	∴ ~A, ∴ B

The label for this rule is "negated if-then" (NIF). The rule: bring down the antecedent WFF as it is but make the consequent WFF the opposite value; you can use one or both.

These three instances of simplification rules demonstrate the general idea that simplification takes a single WFF and breaks it down into its component WFFs. Component WFFs are used in a proof to reach the final WFF in the series.

2.4.3 Implication rules

Implication rules use two WFFs to obtain a third WFF. There are four examples of inference rules, one each for the negated conjunction and disjunction, and two for the material conditional.

Negated conjunction implication requires two distinct WFFs to obtain the third WFF; a negated conjunction and one of its WFF components yield the opposite of the remaining WFF component. Here are two examples:

~(A ·B)	~(A · ~B)
A	~B
∴ ~B	∴ ~A

CS is the label for this rule, for conjunctive syllogism. The rule: from a negated conjunction, from the same WFF component, infers the opposite WFF component.

Disjunction implication requires two distinct WFFs to obtain the third WFF; a disjunction WFF and the exact opposite of one of its WFF components yield the same remaining WFF component. Here are two examples:

(A V B)	(~A V ~B)
~ A	B
∴ B	∴ ~A

Disjunctive syllogism is the name for this rule, which is labelled (DS). The rule: from a disjunction, from the opposite WFF component, infers the same WFF component.

Material conditional implication requires two distinct WFFs to obtain the third WFF. The first material condition inference uses the antecedent WFF and the same WFF to render the same consequent WFF. Here are two examples:

$$\begin{array}{c} (A \supset B) \\ A \\ \hline \therefore B \end{array} \qquad \begin{array}{c} (\sim A \supset \sim B) \\ \sim A \\ \hline \therefore \sim B \end{array}$$

Modus ponens is name for this rule, which is the labelled (MP). The rule: from a conditional, from the same antecedent component WFF, yields the same WFF consequent component.

The second material conditional implication uses the consequent WFF and the opposite of the consequent WFF to render the opposite antecedent WFF. Here are two examples:

$$\begin{array}{c} (A \supset B) \\ \sim B \\ \hline \therefore \sim A \end{array} \qquad \begin{array}{c} (\sim A \supset \sim B) \\ B \\ \hline \therefore A \end{array}$$

Modus tollens is the label for this rule (MT). The rule: from a conditional, from the opposite consequent component WFF, yields the opposite WFF antecedent component.

The syntactic rules of the logical system are the chosen rules for the system to demonstrate the concept of a “proof.” However, there are a few other rules relevant to this thesis.

The rule of addition (ADD), adds a WFF component to another WFF component through the introduction of a disjunction. Any component WFF can be added to any WFF through this rule, simple or complex. Here are two examples of a simple and complex use of the rule:

$$\frac{A}{\therefore (A \vee B)} \qquad \frac{\sim A}{\therefore (\sim A \vee (\sim A \supset \sim B))}$$

In the first instance, only “B” adds to “A”; in the second instance “(~A ͻ ~B)” adds to “~A”. The rule is simply that any WFF can be added to any WFF with a disjunction combining them.

Another rule of implication is hypothetical syllogism (HS). This rule is best understood as chain reasoning, where there are linked premises and the conclusion is the initial WFF’s antecedent, and the consequent WFF is the final premise’s consequent WFF.

$$\begin{array}{l} (\sim A \supset \sim B) \\ (\sim B \supset C) \\ \hline \therefore (\sim A \supset C) \end{array}$$

There is no clear application of this syllogism except in instances when there are numerous conditional WFFs. Pay attention to the antecedent and consequent component WFFs to determine if there is the necessary connection needed for HS.

There two final rules of implication share similarities with *modus ponens* and *modus tollens*. In the constructive dilemma (CD), the conditional WFFs in the conjunction WFF have the same consequent WFFs. In the second premise, the antecedent WFFs of each conditional form a disjunction WFF and the conclusion WFF is the consequent WFF of each conditional.

$$\begin{array}{l} ((A \supset C) \cdot (B \supset C)) \\ (A \vee B) \\ \hline \therefore C \end{array}$$

There is no clear rule application of this syllogism either, except when there are WFFs that fit the proper pattern, or can be generated by the rule of addition, adding to an existing single WFF. The pattern looks somewhat similar to *modus ponens* wherein the antecedents match, so the consequent would follow.

In the destructive dilemma (DD), the conditional WFFs in the conjunction WFF have the same antecedent WFFs. In the second premise, the opposite consequent WFFs of each conditional form a disjunction WFF and the conclusion WFF is the opposite antecedent WFF of each conditional.

((A ɔ B) · (A ɔ C))
(~B V ~C)
____
∴ ~A

There is no clear application of this syllogism except that it can be used when there are WFFs that fit the proper pattern or can be generated by the rule of addition so adding to an existing single WFF. The pattern looks somewhat like *modus tollens* where the consequents are opposite in the second premise, so the opposite of the antecedent would follow as the conclusion.

2.4.4 Proofs

The goal of the syntactic method of propositional logic is to reach or prove a conclusion through a proper application of the transformation rules. Consider the following argument, a destructive syllogism:

1. ((A ↄ B) · (A ↄ C))
2. (~B V ~C)

[∴ ~A

3. asm: A
4. (A ↄ B) AND 1
5. (A ↄ C) AND 1
6. B MP 3, 4
7. C MP 3, 5
8. ~C DS 2, 6
9. ∴ ~A From 3, 7 and 8 contradict

Is there a way to prove this argument valid without reference to truth-values? Yes. Using the *reductio* method of proof, the conclusion is implied. With the method, an assumption that leads to a contradiction must be false. The goal is to get a contradiction, which turns the assumption back to the original value of the conclusion. There are four basic requirements for a *reductio* proof:

> "a) all the original premises must be used at least once;
> b) the assumption must be the opposite of the conclusion;
> c) a contradiction is generated in one of the three ways: either with the assumption, under the assumption, or with one of the original premises; and
> d) the final line of the proof must list the original conclusion, the assumption line number, and the contradiction line numbers" (Gensler 2010:152–157).

The previous argument is valid because the proven method, *reductio* and a proper application of the transformation rules, brought about the conclusion. However, consider the following argument:

1. ((P · Q) ɔ R)

[∴ (Q ɔ R)
2. asm: ~(Q ɔ R)
3. Q NIF 2
4. ~R NIF 2
5. ~(P · Q) MT 1,4
6. ~P CS 3,5
—x—

Unlike the previous proof, there was no generation of a contradiction, although the transformation rules were exhausted. An argument is invalid on the *reductio* method when there is no generation of a contradiction, i.e. through a proper use of the transformation rules.

Proofs are a syntactic way of assessing validity through proper transformation rule use and reaching the desired conclusion. The *reductio* method is one of two main proof methods, the other being conditional proof. Either proof method produces the same result. When rules are applied properly, they correctly assess the argument as valid or invalid if the conclusion can be proven or not. The syntactic method makes no mention of truth-values in determining validity and systems that typically confuse the semantic basis for propositional logic and the syntactic basis.[33]

2.5 Inconsistency and contradiction in propositional logic

In propositional logic, a general definition of "inconsistency" is that a WFF is inconsistent if both component WFFs cannot be true at the same time. The WFF (A · ~A) is an example of this, as it is logically impossible for both component WFFs to be true at the same time as demonstrated by the WFF's truth table. In propositional logic, by definition, a contradiction is a WFF and its negation in a

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[33] Gensler (2012:4) for example uses the definition of "validity" as it would be contradictory or impossible for the premises to be true and the conclusion false. These definitions apply, for him, to both the semantic and syntactic versions.

conjunctive relationship (A · ~A), or ((A · ~A) · ~(A · ~A)). Contradiction is primarily a syntactical concept; inconsistency is primarily a semantical one.

2.5.1 Negation

Expressions of negation in natural language occurs through various cognates of "not." When translating from natural language into propositional language "not" is translated as "~." A formal language needs no interpretation; thus, the symbols should express themselves. "~" in semantic propositional language means reversing the truth-value of the WFF or component of a WFF. In syntactic propositional language "~" means "opposite". However, both meanings determine the nature of negation as exhaustive. Negation in propositional logic does not admit any degrees or limited application. It is a robust concept that either reverses the truth function or directly opposes another WFF.

2.5.2 Inconsistency in arguments

In the presentation of contradiction and inconsistency, the focus of both was on individual WFFs. Both concepts are also operative in proofs and arguments, arguably more so, given the broader scope of arguments. Semantic inconsistency and syntactic contradiction are subject to problems in propositional logic. A discussion of two of these problems follows, *ex falso quodlibet* or EFQ, and *ex contradictione quodlibet* or ECQ.

2.5.2.1 Semantic: *ex falso quodlibet*[34]

Consider the following truth table for the material conditional:

[34] The literature confuses EFQ and ECQ as the same thing, I am using one as a semantic idea and the other as a syntactic idea. Shapiro (2013) uses EFQ instead of ECQ when ECQ (Priest and Berto 2017) is what is used by the paraconsistentist, for instance. Those references are to the *Stanford Encyclopedia of Philosophy*, a reputable source by philosophy scholars, where the two concepts are treated as one.

S	T	$(T \supset S)$
0	0	1
0	1	0
1	0	1
1	1	1

In rows 1 and 3 of the truth table for the material conditional, when the antecedent WFF "T" is false, the overall value is true. Thus, when a material conditional has a false antecedent WFF component, the WFF is always true.

A formal deductive argument shares a similar structure as a material conditional WFF. The semantic definition of validity – i.e. if all the premises are true, the conclusion must be true – is in conditional form. Invalidity can only occur in a truth table when all the premises are true and the conclusion is false. Yet, this is only one truth-value assignment out of many. A simple consequence of the semantic definition of validity is that any argument with a false premise is automatically valid, as is any argument with a true conclusion. The peculiarities of truth and falsity in a material conditional may not make a great deal of sense in an ordinary way, but in terms of the logical system they do. Consider the following truth table for an argument containing a contradiction and an unrelated result:

B	A	$(A \cdot \sim A)$ $\therefore$	B
0	0	0	0
0	1	0	0
1	0	0	1
1	1	0	1

By definition, this argument is valid. There is no row where there are all true premises and a false conclusion. Thus, by default, the argument is valid.

EFQ means "from the false, anything." This concept is often taken as the same concept as ECQ, "from a contradiction, anything." However, if the results of semantic propositional logic are brought to bear on the concept, the contradiction is secondary to the truth-value assignments, manifesting in an argument with a false premise on all assignments leading to a valid argument. So, the falsity, not structure or form, is the primary concept such that anything at all follows validly.

When EFQ was formulated in the Middle Ages the propositional logical apparatus did not exist in the sense of this thesis.[35] However, the intuitive idea was in mind, that a contradiction is false and from the false anything can follow. This interpretation does so in terms of truth-values clarifying how an unconstrained proposition can follow from a contradiction and not violate any conception of validity.

2.5.2.2 Syntactic*: ex contradictione quodlibet*

Consider the following proof sequence in syntactic propositional logic, called ECQ:

1. (P ·~P)
2. P (AND,1)
3. ~P (AND,1)
4. (P V Q) (ADD,2)

∴ Q (DS,3,4)

WFF 1, (P ·~P) is the only original premise; all other premises logically follow from it by proper rule use. WFF 1 becomes WFF 2, by the transformation rule of conjunction simplification. Also reached by conjunction simplification is premise 3 from premise 1. WFF 4 comes via the transformation rule of addition, with the addition of “Q” to “P” from WFF 2. The final WFF, “Q,” is drawn through the transformation rule, disjunctive syllogism. The derived transformation rule is a formal application of the transformation rules that are used in the following sequence:

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[35] See Wittgenstein for an early formulation semantic truth-tables and propositions (2001) and Gentzen (1935a & 1935b) for a method of syntactic proof

DS1. (P V Q)

DS2. ~P

∴ Q

Thus, ECQ's final WFF "Q" is transformed from the initial formula, "(P ·~P)" using the specific transformation rules under the rubric of a single derived transformation rule, ECQ.

On the conception of syntactic propositional language presented here, a contradiction results by definition when a WFF is conjoined with that same negated WFF, viz., (P ·~P). The sequence of ECQ begins with a formal contradiction, proceeds through a few rule-governed transformations, and ends with a distinct variable that is not found in the original contradictory premise. ECQ derives its awkward result from an explicitly formal contradiction in this sense, by an appeal to rule based transformations within a syntactic system.

ECQ displays that from a syntactic contradiction, an unconstrained or "open-ended" conclusion is provable. This unconstrained conclusion is the result of a logical consequence relationship between the premises and the conclusion. This relationship is called "explosive" because any result can follow from a contradiction. This is not a good thing for propositional logic, where a conclusion should have some WFF component of the original premise. In ECQ, the only original premise is "(P ·~P)" and proving a result of "Q" shows no WFF component carryover.

2.6 Concluding thoughts

Turning to the second research question, *what is a correct representation of propositional logic and propositional logic inconsistency*, we find the answer in dual form. Classical propositional logic exists in two manifestations: semantic and syntactic. At the propositional logic level, both manifestations provide the correct result through rule usage. Semantic and syntactic metalogical results demonstrating both ways provide the same result, are known as completeness and compactness proofs. While the manifestations are different in use and application, the results they produce are the same: a valid argument in one will be a valid argument in the other. When translated into the language of propositional logic, natural language may have its relations understood through the austerity of the logical language. Thus, there may be relationships thought of in a different and helpful way when engaging in natural language translation to the language of propositional logic.

Inconsistency in propositional logic shares the dual form, too, as it is either of truth functions or of logical form. On the semantic conception, inconsistency in the form of contradiction is false on all rows of the truth table due to the WFF structure. On the syntactic conception, it is the structure alone that generates the contradictory form. Thus, the research question is answered in two ways.

Classical propositional (with first-order) logic is the dominant logic in use in the Western world. While some Aristotelian logic is still taught, most introductory logic courses focus on propositional logic, predominantly the semantic side but some include the syntactic as well. Propositional logic – one may speculate – would not have attained its dominance without the support of the universities and their belief that formal deductive logic should be taught in both introductory logic courses and critical reasoning courses.[36] Part of this dominance, I would postulate, perhaps comes from the role of the positivists in the 20th century and their influence on the English-speaking universities, especially after World War II. Another contributor, albeit minor, might be the burgeoning textbook market motivating authors to continue the trend that they learned. Still, yet another factor is likely due to an appeal to Aristotle and his logical authority, so justifying some form of logic in the curriculum. Lastly, logic of any kind was thought to be an ideal and the universities might have been wrong about ignoring language based arguments for formal logics and systems. More will be said on this issue in a later chapter, but it is important to note that propositional logic's entrenchment in the

[36] One would be hard pressed to find a higher educational institution that does not offer introduction to logic and/or critical reasoning courses. This pervasiveness may have led to the inclusion of propositional logic in these areas of the curriculum.

curriculum stands as a strong justification for learning propositional logic and not necessarily whether propositional logic is the best logical system to capture formal and informal senses of inference.

This chapter has functioned to give a substantive background understanding of propositional logic for later analysis and critique in this thesis. This will include conceptual problems inherent to propositional logic, especially related to inconsistency. Ultimately it will serve to illustrate why propositional logic has little relevance to critical thinking generally and that propositional logic subverts our ordinary understanding of inconsistency judgements. This subversion, among other elements, are presented in the next chapter.

Chapter 3: Critiquing propositional deductive logic as a logical system

3.1 Introduction

This chapter critiques propositional sentential deductive logic as a logical system. The first subsection considers classical logic in opposition to non-classical logics. The next few sections bring forth some problems for inference rules (in particular, *modus ponens* and *modus tollens*), and quasi-principles of inference (*ex contradictione quodlibet* and *ex falso quodlibet*). The final sections challenge the role of translation between natural and formal language and draw forth some negative consequences.

3.2 Classical and non-classical logics

One major proponent of classical logic is Quine (1980, 1986a & 1986b). Quine is famously known for his rejection of non-classical or deviant logics. He believes that his version of classical logic (propositional and first-order logic) is sufficiently expressive to capture what science needs for an explanation.[37] The system preserves truth and allows one to analyse relations. These relations are both the relations of grammar and formal logic and are manifest in the relationship between the two as well. Quine (1986b:1118–1250) argues against deviant logics, with some of his attacks centring on an improper use or understanding of negation. Other critiques draw out the lack of bivalence of truth and falsity, and problems with quantification. For the purposes of this thesis, the first two are relevant.

[37] Quine's logical system – in *Philosophy of Logic* (1986a & 1986b) – uses conjunction, negation and existential quantification, and two truth values. It qualifies as a classical propositional system with a quantifier. See in particular Chapters 4 and 5. In (1980) Section 10, he supports reduction to negation and conjunction.

One way to understand Quine's difficulties with deviant logics is to think about perspective. Quine's criticisms come from his presuppositions and support of classical logic.[38] Viewing other logics or logical issues through that lens, he is engaging in a system versus system debate. This is not surprising given his known holism about systems providing intelligibility on a whole rather than a system's components.[39] Granted, any criticism is likely to be a criticism of a component, but Quine is thinking in systematic terms. For instance, if a logical system changes the defined meaning and role of propositional negation in one case (e.g. a disjunction [P V ~P]) what is the consequence of that change for the whole system? Does (P ·~P) still contradict? Does negation in a contradiction still function in a classical propositional fashion?

Quine attacks at least two positions: paraconsistency and intuitionism. On the first, he says (1986b:1135–1138):

> "To turn to a popular extravaganza, what if someone were to reject the law of non-contradiction and so accept an occasional sentence and its negation both as true? An answer one hears is that this would vitiate all science. Any conjunction of the form 'p · ~p' logically implies every sentence whatever; therefore, acceptance of one sentence and its negation as true would commit us to accepting every sentence as true, and thus forfeiting all distinction between true and false."

Quine is referring to ECQ here ─ anything follows from a contradiction. Quine believes that accepting a contradiction as true results in trivialism, the view that all sentences are true. If all sentences are true, it can be logically inferred, then, that no sentences are false, and the distinction between the two truth-values fails. Quine sees this as a problem for science because science requires truth and falsity to describe theories and even the world accurately. So, accepting a contradiction as true undermines the intelligibility needed for a successful scientific and even practical enterprise.

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[38] Quine in 1986a (Ch.7) demonstrates this indirectly by critiquing deviant logics and doing so from the standpoint of classical logic. His take on elementary logic (1980) further supports his identification as a classical logician.

[39] Quine's holism develops from belief, to observation, and then to self-evident truths, each of which have a place in his holistic "web" (1979:Chs. 2–4).

Quine proceeds to discuss the role of negation in paraconsistency. He writes (1986b:1139–1142):

> “My view of this dialogue is that neither party knows what he is talking about. They think they are talking about negation, ‘~’, ‘not’; but surely the notation ceased to be recognisable as negation when they took to regarding some conjunctions of the form ‘p · ~p’ as true and stopped regarding such sentences as implying all others. Here, evidently, is the deviant logician’s predicament: when he tries to deny the doctrine he only changes the subject.”

Quine’s position is straightforward, accepting a contradiction would be disastrous. Logically, negation loses its classical propositional meaning. Systematically, the opposition necessary is arbitrary. Some paraconsistent logicians, such as Priest (1979:326–331) in his logic of paradox (LP), explain how to contain a contradiction with the rest of the system being minimally inconsistent. Quine (1986b:1139–1142) believes this position fails as well, because of the same issues with negation. Negation has different meanings in the system, and the structural, systematic integrity fails unlike in classical logic where the meaning of negation stays the same. So, according to Quine, whether accepting a contradiction as true or attempting to limit a contradiction’s negative effect, results in neither group knowing what negation means.

The import of this critique of paraconsistency is that Quine’s thoughts come directly from his support of classical logic, and to the same extent, its relationship to grammar. Quine states (1986a:101), “So, the logical truths being tied to the grammar and not the lexicon, will be among the truths on which all speakers are likeliest to agree.” Quine (1986a:95–97) believes this interconnectedness of the two justifies using classical logic and supporting its expressivity. This is an important point for Quine; classical logic is sufficiently expressive to do what science and the rest of us need to do in potential logical application. If that sufficient expressivity is true, Quine may be right in considering other non-classical logics as changing the subject.

On the second point about intuitionist logic, Quine has equally strong thoughts, although the critique is not as clear given the tenets of this non-classical logic. He writes (1986b:1221–1224):

> "We had been picturing the rejection of the law of excluded middle, "p or -p", mainly as rejection of classical negation. I have now directed the intuitionist's case rather at the alternation. Actually, the distinction is unreal; once you upset the interrelations of the logical operators, you may be said to have revised any or all. Anyway, the intuitionist's negation is deviant also on its own account: the law of double negation lapses."

In intuitionistic logic, proof functions as the essential principle, not truth-values or truth. If one can prove ~A, then A has no proof. Consider the law of excluded middle (LEM), (X V ~X). Intuitionistic logic differs from classical logic with respect to the disjunction. In classical logic, it does not matter which disjunct is true for the whole formula to be true. Intuitionistic logic requires proof of the disjunct. A disjunction of (X V ~X) makes no systematic sense to the intuitionistic logician because both disjuncts cannot be proven, only one can. In a normal disjunction in intuitionistic logic (A V B), both can potentially be proven, as they are different propositions, unlike the LEM. Assume for indirect proof that the LEM cannot be proven, or ~(X V ~X). Using transformation rules acceptable in intuitionist logic:

1. Asm: ~(X V ~X)
2. ~X NOR 1
3. ~~X NOR 1

∴ ~~(X V ~X) from 1, 2 and 3 contradict.

The proof progresses as follows: it is not the case that X or not X; that disjunctive WFF is simplified into its two WFF components and a contradiction results. In intuitionistic logic, double negation can be introduced but not eliminated. Since there is no double negation elimination in intuitionistic logic, the conclusion is double negated. What this demonstrates is two things: first, a weaker form of the LEM is proven (whatever that means) and by contrast, there is no proof for the LEM, so the LEM in its classic form is rejected. However, disjunction still functions in intuitionistic logic when the variables are distinct. The implication is the disjunction in the LEM WFF is functioning differently, as it conflicts with the notion of proof as justification. Second, negation in the propositional sense is different from intuitionistic negation as (X V ~X) is not provable but ~~(X V ~X) is, and they are not equivalent logically.[40]

A few more thoughts about intuitionistic negation are needed. Suppose that numerically 1 = 0 is a contradiction. To define negation in intuitionistic logic, (~X = (X ⊃ (1=0))) requires understanding that proof, not truth, is what justifies a WFF. ~X means that X results in a contradiction, so X is not provable. Notice this definition does not use truth-values but uses provability as the justifying element. This definition of negation has obvious ramifications for Quine's bivalent propositional logic base, as systematically, grammar and classical logic do not relate in the same way to the concept of "proof" or not as they do with "true" and "false."

While the presentation here is in no way a comprehensive treatment of intuitionistic logic, the material demonstrates what Quine believes to be the issue. The systematic sense of classical logic disintegrates when the disjunction fails to function like it normally would and negation much the same. Quine's holism about the relationship between grammar and language would even be called into question, as translatability would be specious in cases of the disjunction and negation for intuitionistic logic. Thus, it seems this ripple effect is disastrous for Quine, as the price of adopting a non-classical logic is too high to overall conceptual and logical intelligibility.

3.3 *Contra* Quine

Quine's passion for classical logic – as his defence considering non-standard logics – is commendable. It is difficult to disagree with his systematic points and the relationship between classical logic and grammar. Yet, there are a few problems with his critique of deviant or non-standard logics and his support for classical logic that need to come to light.

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[40] Fisher (2007:127) clarifies the difference between an indirect proof and a *reductio* proof in intuitionist logic. The former adds a negation operator to the conclusion; the latter takes away the negation operator, which is not an acceptable move. So, an indirect proof and a *reductio* proof are not the same in intuitionist logic as they are in classical logic.

Taking Quine as an exemplar of a classical logician, and those who hold a similar position, there is a supposition made that needs to be argued for. Quine's reference point is classical logic and his critique issues from that foundation. All other views are considered in relation to it. This supposition structures his thought and his critique. However, where is the argument for that supposition? The argument appears to be that grammar and classical logic work well together (1986a:95–97). Therefore, the latter is correct. However, this supposes that no other grammar and logic work well together. In his paper on semantic closure, Priest (1984:121–123) argues for the inconsistency of natural language.[41] If natural language is inconsistent, the resulting logic should be too. Priest's logic of paradox or LP (1979:326–331) contains or limits the effects of logical inconsistencies such as the liar paradox, yet, retains systematic, logical integrity. The containment justifies connectives and logical operators functioning differently in those contexts; yet, the expressiveness of classical logic is largely maintained. If Priest is correct, his logic and grammar are expressive in a wider range of cases than Quine's and simply cannot be dismissed as not fitting the standard mould.

This leads to the next point; Quine's use of "deviant" is an example of poisoning the well (1986a:81). A deviant logic is one that rejects one or more of the basic rules of logic: the law of excluded middle or the law of non-contradiction.[42] "Deviant" can be read in two ways: as deviating from the norm or being bad. Quine initially uses the former, where he writes, "Here, evidently, is the deviant logician's predicament: when he tries to deny the doctrine he only changes the subject" (1986a:81). In this sense, Quine's use of "deviant" is correct; deviating from the norm is like changing the subject in a charitable sense. However, the second conception of "deviant" follows from his presupposition of classical logic being correct. An argument can be made of Quine's set up in the early part of the chapter on deviant logics. He states "It would seem that such an

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[41] "Semantic closure" is a phenomenon found in Tarski (1944) and his work on object languages and metalanguages. Priest uses the results of Tarski's (1944) work and instead of adopting Tarski's object/meta language distinction to avoid inconsistency, embraces the inconsistency and corresponds it to a paraconsistent logic (1979:326–331).

[42] This is my definition given the context of Quine's rejection of paraconsistency (1986a:81) and intuitionism (1986a:83) based on logical law rejection,.

idea of deviation in logic is absurd on the face of it. If sheer logic is not conclusive, what is?" (1986a:81).[43] This attitude takes classical logic as the only logic that is acceptable. Quine (1986a:83) continues this attitude in his discussion of the law of the excluded middle:

> "(1) Every closed sentence is true or false.
> (2) Every closed sentence or its negation is true.
> (3) Every closed sentence is true or not true."

Quine (1986a:83) believes 1 reduces to 2 by supposing falsity as the truth of negation, or false = true negation. Quine (1986a:83) also believes that 3 reduces to 2 by supposing that if a sentence is not true, then its negation is true, or if a sentence is true, its negation is false. By transitive extension then from 3 to 1, a sentence that is not true is false on Quine's view. He concludes (1986a:83) by asserting "These trivial latter lucubrations well illustrate the inanity of trying to discern equivalence in some sense within the domain of logical truth. Logical equivalence…hold indiscriminately between all logical truths." Note the use of "inanity," which is value laden and poisons the well against someone who holds a competing view.

What is this competing view? A "deviant" logician would not grant the move from 3 to 2. "Not true" is not thought to mean just "false." "Not true" can mean "indeterminate" and "true and false," depending on the logic, where the former is in a three-valued logic (Priest 1999a:141–148), and the latter is in a paraconsistent logic (Priest 1999b:104–107). Given this usage of "deviant" by Quine, "non-standard" has been used in its place here, as it is not loaded with a normative value and is charitable.

On the acceptance of contradictions, Quine's quick dismissal of logics (1986a:81) that tolerate inconsistency, like Priest's logic of paradox or LP (1979), is unfair. Priest's logic blocks ECQ, so not everything follows from a contradiction. In fairness to Quine, there may be a time issue with Priest's work appearing in 1979. However, to his detriment, Quine references no paraconsistent source in

[43] "This only begins to illustrate the handicap of having to think within a deviant logic" (Quine 1986a:86)

1986a or 1986b, but lists numerous sources for the intuitionist critique. It seems rather simple to state that negation functions normally, except where it does not in contradiction and paradoxes. There, negation does not behave classically and a logical system that can make sense of that inconsistent behaviour and of the classical behaviour is more robust than one that simply does not.

On the problems with intuitionistic logic, Quine (1986a:87) rightly notes the systematic problem of having negation function in different ways and arguably, disjunction, too. However, this is only an issue if the conception of classical propositional logic is the norm. If a system defines the role of the connectives and negation, the issue is not one intrasystematically, at least for Quine's critique. In fairness to the intuitionistic logician, the primary emphasis of this logic and its mathematics is formal mathematics and gets a handle on the finite versus the infinite through the role of experience. This has very little to do with grammar and the broader issues Quine posits about meaning being part of an integrated holistic system.[44] So negation does not need to function in a way that retains meaning or understanding, and the same can be said for disjunction, with respect to grammar and broader systematic considerations. A formal system stands on its own and interprets itself by definition. Now, if intuitionistic logic is not expressive in the right sort of way as a formal system, that is a different issue and fodder for critique.

The reason for choosing Quine as a sounding board is broader in one sense. While there is no obvious empirical data to cite, only anecdotal, it is fair, but with reservations to posit that Quine is representative of the general attitude toward non-standard logics. Logical education at the graduate level, especially for non-specialists in logic, rarely considers non-standard logics seriously, and, in fact, might not even be exposed to them.[45] However, this group becomes the logic teachers of tomorrow and the justification of classical logic as part of the curriculum goes unchallenged. The lines of Quine are repeated that classical logic is sufficiently expressive, is the best available logic, and propositional logic is

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[44] See Quine (1978:Chs.2–4).
[45] I think the exception is probably modal logic, especially if a contemporary analytic metaphysics seminar or a philosophy or religion course is taken. Normally, however, this only involves symbolized WFFs and very little actual use of a modal system, say S5.

taught as the ideal. Maybe it is the ideal, but that should be critically considered and evaluated to ensure students get the best logical education possible, not simply one that is passed down because it is passed down.[46]

3.4 Propositional logic

The critique of propositional logic consists of five different areas. The first area concentrates on a problem with taking principles of inference and transformation rules as the same thing. Two examples of this are found in *modus ponens* and *modus tollens*. The second area details problems with EFQ as a principle of inference; the third area does the same thing with ECQ as a principle of inference. The fourth area introduces a new logical consequence relationship and compares it with the one found in propositional logic. The final area considers some thoughts on translation between classical propositional logic and natural language, which questions the expressiveness of the former in relation to the latter.

3.4.1 Principles of inference versus implicative transformation rules

Implicative transformation rules are logical rules that transform one set of symbols into another set of symbols. This is a formal manipulation of the symbols according to rules prescribed by the system. By definition, the implicative transformation rules are intrasystematic and rely on the system for intelligibility and justification. Principles of inference are patterns of reasoning that display relations of ideas and are normally thought to be correct forms of reasoning. They also involve beliefs about the premises, such that the premises support belief in the conclusion. Consider *modus ponens*:

[46] It is important to recognize that classical logic – propositional and first-order – is taught not just for future teaching but also for reading and interpreting the philosophical literature. In this way it becomes self-justifying: you must learn classical logic to read the literature which contains classical logic, so it must be important.

1. $(A \supset B)$
2. A

$\therefore B$

This proof is an implicative transformation of symbols in syntactic propositional logic. There is no belief needed in the premises or conclusion, only an understanding of the rules, which if a belief, is separate from the belief in the premises. However, it is not a stretch to believe that someone can look at the pattern and believe that the conclusion “B” results from the two premises. In this sense, it is a principle of inference because it is taken as an argument not a proof, or better yet, a derivation. Principles of inference are extrasystematic because their use takes place outside of a formal logical system. Think through the following argument:

1. If Scott weighs 100 kgs. then Cancun is in Mexico.
2. Scott weighs 100 kgs.

∴ Cancun is in Mexico.

This instance of the principle of inference, *modus ponens,* consists of no WFFs nor formal symbol manipulation according to transformation rules. Belief in the conclusion follows from belief in the premises and the pattern aids in confirming the concluding belief.

There has been little critical reflection on this tenuous relationship between transformation rules and principles of inference. In fact, to many, they are the same thing in principle if not in form. However, even with *modus ponens* and *modus tollens*, they can be shown to be different, which is the goal of the next subsection.

3.4.1.1 Problems with *modus ponens* and *modus tollens*

Reflect on the following argument from Vann McGee (1985) on *modus ponens*:

> "1. If a Republican wins the election, then if it is not Reagan who wins it will be Anderson.
> 2. A Republican will win the election.
>
> ---
>
> ∴ If it is not Reagan who wins it, it will be Anderson."

McGee asserts that someone can believe the premises but not believe the conclusion (1985:463). Anderson was the third-place Republican candidate, with Jimmy Carter, a Democrat, the second-place candidate. Believing the first two premises, given the context, is not controversial. However, believing the conclusion is problematic because if Reagan does not win, it would be Carter, not Anderson.

McGee uses the standard pattern of *modus ponens*, but with a twist on the content in the consequent in the first premise. He uses another conditional statement in the consequent; there is no obvious prohibition in natural language in doing that, as the basic pattern is satisfied. It is an invalid argument by truth functional assessment, with true premises together with a false conclusion.

However, consider the syntactic equivalent of *modus ponens* with transformation rules. As an implicative transformation rule, *modus ponens* is a valid propositional deductive sequence, which is shown by the derivation of the logical form of this proof with a nested conditional.

1. (R ⊃ (~E ⊃ A))
2. R

[∴ (~E ⊃ A)

3. asm: ~(~E⊃ A)
4. ~R MT, 1,3

∴ (~E ⊃ A) from 3, 2 and 4 contradict

The final result is the logical consequence of a proper application of the transformation rules; the argument is syntactically valid.

Thus, as a principle of inference, it is invalid as an argument and as a propositional proof, it is valid. This illuminates a conflict between the semantic and syntactic account of *modus ponens* and, as McGee notes, the indicative conditional in English and the material conditional of logic are different (1985:463).

Modus tollens suffers a similar fate. Consider the following argument in the *modus tollens* pattern from Gauker (1994:140):

> "1. If I am going to be in Cincinnati on Friday, then it is necessarily possible that I will be in Cincinnati on Friday.
> 2. It is not the case it is necessarily possible that I will be in Cincinnati on Friday.
> ____
> ∴ It is not the case I am going to be in Cincinnati on Friday."

Gauker explains that the first premise is a logical truth. In the antecedent is an actuality claim, whereas the consequent is a possibility claim. How is it possible that the antecedent could be true and the weaker claim could not? It is not, so the conclusion must then follow from the second premise alone. Paraphrasing the second premise for easier understanding, it is possibly necessary that I will not be in Cincinnati on Friday, and it does not follow from that premise that I am not going to be in Cincinnati on Friday.[47] The second premise attempts to infer from possibility to actuality in the conclusion, and that is illicit. The argument is invalid, as the premises are true but the conclusion is false.

Gauker's argument works by taking the normal pattern of *modus tollens* and substituting in modal language of possibility and necessity. Some might find that objectionable because although the argument form is valid, the semantics make it invalid after the fact. However, if *modus tollens* as a principle of inference is sufficiently expressive and truth conducive, there should be no issue with that form of the argument. The argument is invalid as it sits with the modal language calling into question its pattern of inference.

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[47] This paragraph is largely a paraphrase of Gauker's explanation of the argument, but shortened (1994:140).

However, consider the syntactic equivalent of *modus tollens* with transformation rules. As an implicative transformation rule, *modus tollens* is a valid propositional deductive sequence, which is shown by the derivation of the logical form of this proof:

1. (C ⊃ N)
2. ~N

[∴ ~C
3. asm: C
4. N MP, 1,3

∴ ~C from 3, 2 and 4 contradict

The final result is the logical consequence of a proper application of the transformation rules; the argument is syntactically valid.

Thus, as a principle of inference *modus tollens* is invalid in the argument with modal language and as a propositional proof, it is valid. This demonstrates a conflict between the semantic and syntactic account of *modus tollens*, and one between a principle of inference and an implicative transformation rule.[48]

3.4.2 *Contra* EFQ

Let us begin with a brief review of the logical concepts to be considered. Consider the following truth table for a semantic argument containing a contradiction and an unrelated result:

[48] Montague (1970:222) is another who sees the relationship between the two as the same. He writes: "There is in my opinion no important theoretical difference between natural languages and the artificial languages of logicians; indeed, I consider it possible to comprehend the syntax and semantics of both kinds of languages within a single natural and mathematically precise theory."

B	A	(A · ~A)	∴	B
0	0	0		0
0	1	0		0
1	0	0		1
1	1	0		1

By definition, this argument is valid. There is no row where all the premises are true together with a false conclusion, thus by default, the argument is valid.

Ex falso quodlibet means “from the false, anything.” It is important to note the language of EFQ, “false” in particular, as it is a semantic notion. On the interpretation of this thesis, the medieval principle was reinterpreted with the propositional truth table. When the results of semantic propositional logic are brought to bear on the concept, the contradictory form is secondary to the truth-value assignments, manifesting in an argument with a false premise on all assignments leading to a valid argument. So, the falsity, not structure or form, is the primary concept such that anything at all follows validly.

Contradictions are not the only false WFFs in propositional logic, consider the following:

B	A	~(A ⊃ A)	∴	B
0	0	0		0
0	1	0		0
1	0	0		1
1	1	0		1

False implies truth and falsity but it does not necessarily need to be a contradiction as the WFF “~(A ⊃ A)” is truth functionally false on all accounts. It is not a contradiction, by definition, as it does not contain a component WFF and its negation brought together in a logical relation with a conjunction.

The WFFs "~(A ⊃ A)" and "(A ·~A)" are truth functionally equivalent, which means according to the values in the truth table they are equal. Semantically, there is no difference between the two WFFs, as the meaning of the formula is its truth conditions. Yet, there are no objections to ~(A ⊃ A) as a WFF or a constructed principle of inference about a negated conditional with the same variables and that anything can follow.

One may be tempted to bring in formula equivalencies and argue "~(A ⊃ A)" and "(A ·~A)" are equivalent formulas. Yes, in the sense of truth conditions, they are the same. However, in the sense of a definition of "contradiction," they are not the same. The classical logician wants these workarounds to the formulas that are semantically false on all truth-value assignments, and they are not entitled to it.

Consider an objection that the critique of EFQ here misses the point: EFQ is just about contradictory logical form and not its semantics or truth conditions. However, contradictory logical form is the domain of ECQ, which is explicitly about a formal contradiction and the implication of the "anything" conclusion. EFQ illicitly supposes that a contradiction is the only problematic notion in logic such that anything follows from it and by definition; it is because the contradictory WFF is *false*. The logical fact of the material conditional and conditional inference in general, support that – in terms of truth-values – any value follows from the false. The use of "anything" is an "open-ended" characterisation with respect to truth-values. One might even define EFQ as: from the false any truth-value in classical propositional logic follows. That definition seems much more appropriate given the semantic basis for it.

There is one final point to make about EFQ or the negated conditional argument. Both are valid arguments. The semantic definition of validity is, if all the premises are true, the conclusion must be true, too. An argument with all false truth conditions in the premises is automatically valid. This set of truth conditions meets the structural requirements of a valid deductive argument where truth would be transferred to the conclusion were the premise truth conditions different.

It is an interesting consequence of classical propositional semantic logic that any supposed problem with EFQ is extrasystematic. The assessment that anything following from the false as a principle of inference is not an internal systematic logical problem. Semantic propositional logic evaluates EFQ as valid; there is nothing illicit about it or its result. Anything illicit is brought in by the conception of EFQ as a principle of inference and by the logical form of the contradictory WFF alone. The logical form is secondary to the truth-value of the contradictory WFF, as the truth-values, in particular, any value following from the false.

3.4.3 *Contra* ECQ

The transformation rules used in propositional logic change one WFF into another WFF. Eventually, the transformational sequence ends with a result. Another name for the implicative transformational sequence is *derivation*. In a derivation in a formal system, one moves from WFFs to other WFFs through proper rule use. A derivation, taken as a whole, shows what can count as the final WFF in the transformational sequence, viz., the derivation shows what the rules allow to count as a final WFF. To underwrite this concept, consider a standard direct derivation:

1. $(A \cdot B)$
2. $(\sim A \vee C)$

---

3. A (AND 1)

$\therefore$ C (DS, 2,3)

From the two initial WFFs, 1 and 2, WFF 3 is derived by the rule of conjunction simplification. The final WFF is implied by the rule of a disjunctive syllogism from premises 2 and 3. Both rules used are part of the system of propositional logic, so “C” as a final WFF was reached by their application in that derivation.

One should pay attention to the intrasystematic nature of a derivation. The logical system limits, defines, and licences accepted moves; any deviation violates the integrity of the logical system. The rules work together to produce unique WFFs. One might even think of a derivation as a *transformational game*. The purpose of the game is to reach a particular WFF (or a result) from one or more initial WFFs. Much like a puzzle, one uses different strategies and combinations of rules to obtain the result. The rules are applied *ad hoc*; one choses the ones that work just because they work. The only general constraint is that the result must be derived from the initial WFFs by the formal system's stipulated transformation rules.

As a syntactic derivation, ECQ starts with initial WFF and reaches the result through rule following. The derivation is a legitimate one. "Legitimate" is merely shorthand for using rules in a proper manner according to their systematic definition. In other words, one obtains ECQ's result through a proper implicative transformational sequence.[49]

However, some classical logicians (Quine 1986b:1135–1138; Gamut 1990:139; Kneale & Kneale 1962:542; & Lewis & Langford 1932: 250–252), believe something very different about ECQ.[50] For them, ECQ shows a flaw about a unique kind of WFF. The original WFF, "(P · P)," licences a transformational sequence that results in "Q." They identify "Q" as an awkward result, which is

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[49] It bears making an obvious point, a contradiction directly entails its components through conjunction simplification. That is the direct result of a contradiction. ECQ adds disjunctive syllogism in the derivation and that is the source of the "open-ended" characterization. Systematically this is an important point that it takes more than a contradiction to generate the "open-ended" result:

1. (A ·~A)	1. (A ·~A)
∴ A AND, 1	∴ ~A AND, 1

[50] It is worth noting that ECQ and EFQ are run together in the literature. When a logician provides a proof that anything follows from a contradiction, that is done without reference to truth-values and should be called "ECQ". Gamut's textbook (1990:137–139) justifies a minimal logic, adds EFQ – which is the same as ECQ for us – and double negation to end up with classical logic. Thus, for him, EFQ as ECQ is integral to classical logic. Lewis and Langford's famous proof of ECQ, I surmise brought this "problem" of logic back into relevance. Kneale and Kneale (1962:542), as part of the discussion of Gentzen's natural deduction system demonstrate the concept of ECQ through rule 6, without naming it as such. These are but a few examples of ECQ or EFQ (depending on how it is characterized) found in the literature. Woods (2003:Ch.1) contains a wide ranging discussion of EFQ (ECQ for us) showing the effects of the Lewis-Langford proof on subsequent logical development and how logics, like relevant logic, rejected EFQ.

“open-ended.” What “open-ended” means at this point is not clear given the presentation thus far. However, one can surmise something about it. Whatever it means, it does not have anything to do with the formal nature of the system as articulated through applications of the transformation rules and the posits of syntactic propositional logic. Instead, it appears that ECQ is purportedly saying something about the formal system that the formal system itself would not licence, much like the previous critique of EFQ.

Nevertheless, something needs to be said about what ECQ is doing for these philosophers and logicians. For that, it is important to discover that the “open-ended” characterisation comes from modelling a principle of inference on the implicative transformation rules. Variables have propositional significance and represent themselves in the system. Transformation rules change these variables into other variables and ultimately a result. At each step or each line in a transformation, there are premises that support a conclusion. Notice the modelling of the premises onto the variables and conclusion onto a result. At this initial stage, the modelling of the two seems relatively straightforward and uncontentious.

However, the final part of the modelling is not so straightforward. The classical propositional logician must show how a principle of inference captures the same significance that the implicative transformation rules have for a formal system. A principle of inference is a way to draw conclusion(s) based upon the belief(s) about the premise(s). These principles are found in deductive arguments, where a deductive argument has a conclusion with some premises supporting that conclusion over other ones. When viewing ECQ as a deductive argument and taking the contradiction as the sole premise, the belief that the contradiction is flawed supports the belief that the conclusion is flawed too. In other words, when beginning with a flaw, you may end up with one, too.

What is this flaw exactly? One principle of inference used says that in a deductive argument a variable or what that variable represents in your original premise(s) *must be* found in the conclusion, too.[51] For example:

1. Los Angeles is in Arizona, or El Guero Canelo is in Tucson, Arizona.
2. Los Angeles is not in Arizona.

∴ El Guero Canelo is in Tucson, Arizona.

Notice that we find some of the content of premise 1 in the conclusion (i.e. “El Guero Canelo is in Tucson, Arizona”). If some (or all) of the content from the original premises is not found in the conclusion, the conclusion is “open-ended”:

1. Los Angeles is in Arizona, and Los Angeles is not in Arizona.

∴ El Guero Canelo is in Tucson, Arizona.

ECQ, *as a principle of inference*, is captured by this deductive argument: from a contradiction as a premise, any conclusion follows.[52] Thus, taken as a principle of inference, ECQ supports the belief that in a deductive argument what is in a contradictory premise is not in the conclusion, thus, the conclusion is flawed.

If the previous thoughts are correct, two pictures of ECQ follow. The first is an implicative transformation game where the nature of propositional logic allows one to move from a WFF to a result via the legitimate application of the system’s transformation rules. The second is a principle of inference where belief in a contradiction as a premise leads to a belief in a flawed conclusion. These conceptions are very different in origin, and the classical propositional logician supposes that they are isomorphic. For them, ECQ – as an implicative transformational sequence – is the model of ECQ as a principle of inference.

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[51] A disjunctive syllogism is employed here as an example of how a variable – or what it represents – is also found in the conclusion.
[52] Later, I argue that ECQ and EFQ are not principles of inference, instead they are principles of implication.

However, it is in our interests to question the legitimacy of this attempt at modelling the latter on the former. If they are not isomorphic, an explanation must follow.

In questioning the modelling, one needs to pay attention to the intrasystematic/extrasystematic distinction. What is said, can be said in terms of, and in definitions of, the logical system. The first conception of ECQ uses the logical language of the system to talk about ECQ. There is nothing illicit about the transformation from one WFF into another. Nor is there anything illicit about the WFF that we call a “contradiction”. There is no evaluative language in the formal system. Thus, any “flaw” will need to be found elsewhere.

The second picture shows a genuine concern with what might be called the *extrasystematic* element doing the work here. As previously mentioned, principles of inference use the concepts of *premises* and *conclusion,* and as stated, these function in particular ways filling out the concept of an *argument*. Premises model the WFFs and the conclusion models of the final WFF (or result) in the implicative transformational sequence. However, this modelling begs the question at a higher-level for it supposes that a derivation and an argument are the same thing. Since a derivation is an implicative transformational game of WFFs into other WFFs, one needs to explain the isomorphism by way of the language of argument. At the core of the explanation is the supposition that *implicative transformation rules are principles of inference*. The belief in WFFs as premises, transformed through rules into a WFF as a conclusion, purportedly models *argument* onto *derivation*. We then have an apparent isomorphism, viz., ECQ as a principle of inference just paraphrases ECQ as a derivation.

It is time to consider the legitimacy of supposing that a deductive argument says the same thing that a derivation does; especially given the fact that a derivation stands on its own, as one residing in a formal logical system. Coming with the extrasystematic deductive argument picture, are additional semantic notions and inferential moves not licensed by what is formally intrasystematic to propositional logic. While classical logicians may support the isomorphism put forth here, one must question whether the language of argument is a legitimate way to articulate the language of derivation.

Does ECQ as a principle of inference correctly articulate ECQ as an implicative derivation? Setting aside the generalities about argument and derivation for now, simply consider ECQ's result (as a principle of inference), "anything follows from a contradiction." Even granting the semantic notion of "contradiction" that we have defined for our formal system, the derivation begins with a WFF and ends with another WFF as a result. The symbols in the final WFF are *uninterpreted* just like those leading up to it. The moment the classical propositional logician forgets that the symbols in WFFs are *uninterpreted* in the formal system of classical logic, illegitimate characterisations result.

Specifically, propositional significance is given to the WFFs making them interpreted. As an example, consider the difference in significance between "anything" in ECQ as an argument and the final WFF in ECQ as a derivation. There is no obvious similarity in meaning between "anything" and the final uninterpreted WFF. It is only when beliefs about the derivation are applied as a principle of inference that we gain the similarity in meaning. That meaning is clearly extrasystematic and not part of the derivational, syntactic conception.

Moreover, supposing a priority on the intrasystematicity of classical propositional logic as the source of significance for the lack of isomorphism, the formal system stands on its own as a representation of itself. The skill being pressed upon becomes one of noticing what the formal system sanctions and what it does not. This skill draws out a vital distinction of formal transformations as reasoning intrasystematically in classical logic and everyday or naïve reasoning, which is extrasystematic to classical propositional logic.

If all of this is right, it implies two things. First, the classical logician's view of contradiction is incorrect even within one's own theoretical assumptions. A formal contradiction is just a WFF based upon the formation rules of the formal system of classical logic. There is nothing illicit about its formation. More so, there is nothing illicit about applying the transformation rules to a formal contradiction and getting any number of results. The transformation game helps us to understand why someone would use the rules and apply them to any WFF (i.e. doing it for symbol manipulation). Thus, ECQ as a transformation game registers nothing illicit about a contradiction and any of its transformational results.

Second, classical logicians view ECQ as a principle of inference that reads a particular characterisation from the derivation, which takes the implicative transformational sequence as an ideal case of inference. However, one must question that characterisation because what is being read off the implicative transformational sequence may not be ideal or even relevant to human practice. For example, consider the rule of addition, where any variable is joined with another via disjunction. So, from “P”, we derive “(P V Q).” Formally, that move is acceptable. However, put in an ordinary language argument, an unintuitive result follows:

1. The New Zealand All Blacks are the best team in rugby.

∴ The New Zealand All Blacks are the best team in rugby or London is hot.

We do not reason like this implicative pattern in everyday life as Wright (1999: 203–206) asserts. However, with classical propositional logic as the ideal and implicative symbolic transformations as the ideal basis for inference, we get these kinds of – what many think are – paradigmatic cases of proper inference. The intrasystematic implicative nature of the formal system makes possible certain moves that appear to be significant in more than one way when read in a particular way. However, that very significance is not one necessarily expressed by a principle of inference such as ECQ or ADD. Thus, taking the significance of ECQ as a principle of inference from the transformational game as an ideal, results in a failed isomorphism. As a syntactic derivation, ECQ stands as a proper application of implication rule. Yet, ECQ’s standing as a principle of inference is questionable at best, false at worst. The extrasystemic use of ECQ as a principle of inference is different in scope and application from ECQ as an implicative pattern. There is also a confusion of derivation with argument. Thus, ECQ’s inferential role and its awkward result should be challenged as to its practical significance in the broader concept of argument, especially natural language arguments.[53]

3.4.4 Monotonicity, non-monotonicity, and constrained conclusions

The logical consequence is a relation between premises and conclusion(s). The deductive logical consequence has two formulations, semantic and syntactic. The semantic formulation is defined as: $\alpha \models \beta$, where α is a group of true premises and β is the conclusion, and there is no instance where α is true as well as β is false. The syntactic formulation is defined as: $\alpha \vdash \beta$, where α is a group of WFF premises and β is the conclusion WFF, and there is no instance where α does not result in β through proper transformation rule application or derivation.[54] Suppose on both formulations, $\alpha \models \beta$, and $\alpha \vdash \beta$, that an additional group of premises or WFFs are added resulting in $\alpha \cdot \gamma \models \beta$ and $\alpha \cdot \gamma \vdash \beta$; the fact that γ is added to the existing premise group and the conclusion or resulting WFF does not change shows that both relations are monotonic.[55]

However, imagine a different scenario where $\alpha \cdot \gamma \models \beta \vee \theta$ and $\alpha \cdot \gamma \vdash \beta \vee \theta$. The additional premises or WFFs can bring about a revision of the conclusion or the transformational result, and the result is the relations are non-monotonic. However, the problem with non-monotonicity is that it is not normally characterised as a deductive relationship, especially a syntactic one as presented here. Typically, both abductive and inductive arguments exhibit the non-monotonic consequence relationship, as additional information to the premises leads to new conclusions.

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[53] Wittgenstein in the *Remarks on the Foundations of Mathematics* (1994:123) concludes that contradictions are senseless. ECQ as implication has sense, given the holistic nature of system meaning. ECQ as a principle of inference, may be senseless. I do not offer an argument for that here, but the lack of sense of connection between premises and conclusion in ECQ would certainly substantiate for this view.

[54] These are my definitions of the two types of logical consequence; there are stricter versions. These were purposely formed to avoid model-theoretic language and proof language, ambiguous to the presented logical system.

[55] I have purposely avoided set theoretic language for ease of explanation and to continue using the already defined logical symbols.

The discussion of monotonicity and non-monotonicity is helpful for understanding logical consequence relations, but it is not clear how it relates to a propositional logic and a critique thereof. In the previous discussions of EFQ and ECQ as principles of inference, both raised questions about the “open-ended” characterisation of the conclusion. Both conclusions were systematically acceptable, whether in terms of truth-values or transformation rules. As principles of inference, the “open-ended” characterisation was specious because it did not represent what the formal logical system sanctions.

As principles of inference, both EFQ and ECQ have monotonic consequence relations in the logical system itself, whether syntactic or semantic. In this way, all four share this specific logical consequence relation. If additional premises were added to EFQ or ECQ as principles of inference, the contradiction would be the only thing that matters to the arguments, as it takes a significance based on its form and the other premises would be disregarded. Most likely the “open-ended” conclusion would remain with no change. However, imagine a valid argument where a contradiction is added to it; unlike the previous case where the same conclusion would be drawn, a different one would likely be, an “open-ended” one. This looks a great deal like a non-monotonic argument, where the revision of premises, or addition in this case of a single premise, ends up changing the conclusion. The import of this is a bias toward contradictions in a monotonic system, when, by definition, if a contradiction is added to an argument, it should not change the conclusion.

One final thought is important on the relation of contradictions and monotonicity. The monotonic logical consequence relation in classical logic is part of the reason that an “open-ended” conclusion results. Once a contradiction manifests in an argument, the principle of inference takes over, and provides the “open-ended” result. Reconsider the definition of a non-monotonic consequence relation, both semantic and syntactic, $\alpha \cdot \gamma \vDash \beta \vee \theta$ and $\alpha \cdot \gamma \vdash \beta \vee \theta$. The conclusion can be the original one or one drawn from the new premise(s) added to the argument. However, in both cases, it is constrained to something that is relevant to the premises. Even with this additional option, the conclusion cannot be simply anything one desires, if the argument is a serious one. Case in point, because of semantic closure where a language has self-reference of predicates, a contradiction results (e.g. the liar paradox). Once a contradiction results, the language should lose its meaning because of the trivial effect of a contradiction in a system. However, it does not. Like the non-monotonic consequence relation, one could accept the “open-ended” result or accept something relevant to the premises that the contradiction does not have that effect on language. However, even with this option, the conclusion is still constrained and not “open-ended”.

What one can learn from monotonicity and non-monotonicity is that when a contradiction is added to the argument, it is the choice of the one evaluating the argument to let the contradiction dictate a result or not. Humans interact with logic to produce results, and a contradiction does not necessitate an “open-ended” conclusion, especially when other premises are in the argument. As principles of inference EFQ and ECQ prioritise the role of contradictions, especially when their role in classical logic is taken as disruptive and infectious. However, adopting a non-monotonic mind-set in a monotonic world might be the mature thing to do with contradictions. Thus, one could determine what they are actually doing, before a principle of inference is blindly followed to its logical result.

3.4.5 ***Contra*-translations as representative of natural language arguments**

Translation from natural language into propositional language has, as its main function, the detailing of the logical relations of the sentence or argument. The logical relations are supposedly more clearly analysed in the translated form of WFFs and symbols. In this sense, going from a robust natural language to a simplified logical language should provide clarity.

The underlying assumptions of the translation process is that there is a correspondence between the two languages, and that the formal language expresses the natural language in a relevant way. Translation is typically one directional: from the natural language to the propositional logical language. The representation of the natural language sentence or argument is manifest in the propositional language’s symbolic interpretation as the final word on the relevant logical relations.

At least one logical connective accurately represents the natural language counterpart: conjunction. The logical relations of the conjunction in propositional logic and in English are similar enough not to warrant any discussion of problems. Conjunction in translation is found in its natural language equivalents of the coordinating conjunctions “and” and “but.”

The other logical connectives and operator do not fare as well in this translation schema. The inclusive disjunction, represented by “or” in a natural language, has truth conditions that are not intuitive. Typically, “or” means “one or the other,” but not both. Classical propositional logic uses the inclusive disjunction, which does not capture the typical usage of “or” and the inclusive sense then has truth conditions that do not align with common intuitions, where the WFF is true when both disjuncts are true. A conclusion in an argument where both disjuncts are true in natural language, is difficult to find. Examples can be constructed, but that does not mean they are relevant to human linguistic practice.

The material conditional of classical propositional logic derives its meaning from its truth conditions. When the antecedent is false irrespective of the truth-value of the consequent, or the consequent is true irrespective of the value of the antecedent, the overall value for the material conditional is true. These results are not intuitive and do not have a clear carry over to natural language. Most examples of these in natural language suppose a relevance between the antecedent and consequent, which poisons the well in understanding how the material conditional functions.[56] In natural language, ordinary conditional statements in use imply a relationship between the antecedent and the consequent, such that they are relevant to each other. Typically, the strict conditional is defined as it is impossible for the consequent to be false and the

[56] Gensler (2010:122) uses semantically relevant antecedents and consequents in his translation exercises. When he gets to truth tables, the first example is: “If I went to Paris, then I went to Quebec.” A discerning geographic mind realizes these two are far apart on the globe, however there is relevance in travelling. His second example shows no connection between the antecedent and consequent: “If I had eggs for breakfast, then the world will end at noon”, which shows the material conditional as a propositional connective based on truth values of the components. Students, may stumble at that part of the chapter, though, as questions arise about relevance and why the antecedent and consequent do not need to be connected as they are in ordinary usage.

antecedent true. (Bacon, Detlefsen & McCarty 1999:79–80). Modal logicians have defined the strict conditional with the necessity operator, $\Box$ (A→B), but that requires a non-standard logic. However, the modal operator makes the necessity between the antecedent and consequent apparent, necessarily if A then B. Arguably, this necessity underlies the natural language conception of the conditional, and that is not found in the material conditional.

A brief tangent is necessary on the material conditional in *modus ponens* and *modus tollens*. The semantic material conditional is truth functionally based. However, the syntactic material conditional is not. The meaning of the syntactic material conditional is the rules that manipulate it, in this case, *modus ponens* and *modus tollens*. This use is much different from the truth functional use. The unintuitive truth conditions of the material conditional dissolve in the syntactic transformation. Taking the two rules, the material conditional's logical behaviour is much more like a strict conditional in the transformation rules; it affirms a necessity with the antecedent in *modus ponens* and denies a connection with the consequent in *modus tollens*. This bifurcation of use leads, at least minimally, to a different sense of translational agreement with the natural language when translating into a syntactic version of derivation versus a semantic argument.

There are sustained arguments in the literature that the material conditional is not truth functional and is best characterised as probabilistic (Edgington 1986, Adams 1975, Stalnaker 1970 & Lewis 1976). In this view, the translation woes seem to be further complicated, as natural language conditionals may not be truth functional. Thus, any translation into classical propositional logic is an expressive failure if the translation is supposed to capture the natural language meaning.

The logical connectives, save one, suffer from translation problems when translating natural language into the logical language of propositional logic. In one sense this is systematic because the logical language is a different language, something not always made clear, and so it will have issues. However, the question arises, whether it best expresses what goes on in natural language. The cases of the inclusive disjunction and the material conditional are questionable.

However, the more important issue is a pedagogical one that is addressed in a future chapter: are students being taught that this is the best expression of natural language in a formal system? Perception versus reality is different in the case of classical propositional logic aligning in the way it is often taught.

3.5 Negation, translation, and WFFs

In natural language English, “not” functions as negation. It is then translated into the propositional logical language as a symbol “~.” When “~” is affixed to any WFF in semantic propositional logic, it reverses the truth-value of the WFF. When “~” is affixed to any WFF in syntactic propositional logic, a different transformation rule applies to the WFF. In this sense, “~” functions in two ways and has two meanings in propositional logic.[57]

Consider two sentence forms, “x is bald” and “x is not bald” where “x” is a variable.[58] On the surface reading, this pair appears contradictory given the negation of the predicate. Substituting “Scott” for the “x”, the two sentences are *contradictory*. However, substituting “An adverb” for the “x”, the two sentences are *contrary*, as they are both false; an adverb is not the kind of thing that is bald or not (Horn 1989:268–269).[59] This subtlety between the contrary and the contradictory is not expressed by “not,” let alone accurately translated into propositional logic language.

Drawing upon Aristotle, Horn (1989:19–21) clarifies how to distinguish between contraries and contradictories. Contrary sentences hold to the LNC, and contradictory sentences hold to the LNC and LEM. The addition of the LEM to the requirement for a contradiction necessitates one sentence being true, unlike in a contrary where both can be false.

[57] The claim here is not that both systems, semantic and syntactic, do not produce the same result; there is no contesting the soundness and completeness of propositional logic at the metalogical level.
[58] “Bald” is to be understood as a non-vague term in this case, there is no philosophical point being made about its fine-grained or sorites-like application.
[59] To be fair, Horn (1989:268–269) makes a different point here; the view supported is that of Aristotle and his views of contraries (*De Interpretatione* and *Prior Analytics,* [1984]).

If Aristotle is right – *via* Horn (1989) – about the logical distinction between the two logical concepts, the logical judgement necessary to ascertain the difference comes secondary to logical form and requires someone versed in basic logical laws. If the sentence is judged as a contrary, it is not clear how that should be translated into propositional logic language instead of a contradiction, other than some *ad hoc* means of not negating the same formula. So, instead of (A ·~A) for a contradiction, the translation is (A ·~B), which is distinct and meets the logical requirement that both WFFs can be false.[60] This translation violates the LNC condition though, so the other option is ((A ·~A) V B), which is not a translation that comes easily to basic translation competency and the reason why it is done that way.[61] The interpretation of this WFF is one of "A" or "~A" can be true, or B is true, which represents that position that they are both false. Another option in propositional logic formulation, not Aristotelian influenced, is the exclusive disjunction.[62] Contraries meet the exact truth conditions of an exclusive disjunction, with two WFF:

B	A	(A V B)
0	0	0
0	1	1
1	0	1
1	1	0

The problem with this interpretation is that it is not intuitive in natural language unless one has been instructed to do this with a contrary formula. To not negate the formula and instead offer a distinct variable is not intuitive. To be clear, negation is not translated which is an *ad hoc* rule and the result is a WFF as a distinct variable in its place. All these differences between contraries and contradictories in natural language, which itself requires some logical education,

[60] An obvious point, both WFFs in a contradiction cannot be false, so this seems to be either just an issue of form without truth values, or truth values that do not apply to the form, or it is the wrong logical form.
[61] Aristotle's syllogistic logic and its square of opposition has definite translations for contrary statements. However, the statements of propositional logic do not fit that linguistic structure.
[62] Wittgenstein in the *Tractatus* (2001:§5.1), uses exclusive disjunction.

implies that translating the difference between the two requires even more education, especially because there is no clear answer.

One final area of negation needs more refinement. “Not” or “no” in a contrary does not have the opposite truth-value function, when they are both false, supposing the contradictory logical form. Arguably, the contradictory form is establishing the conflict, when the form overstates the function of “not”, both conjuncts are a false case. If one conjunct is true, the appearance is that the opposite truth-value function holds classically, but that is distinct from the both false use of negation. This is a suppressed sense of negation in natural language different from the opposing concept of negation. “Not” then functions in at least two different ways just based on its logical character in a contrary. Thus, “not” in natural language simply resists being captured by a bivalent relation of classical propositional logic.[63]

3.6 Concluding thoughts

Let us reconsider the third research question, *what are the essential elements of a substantive critique of propositional logic and propositional logic inconsistency?* Propositional logic suffers from translation problems, connective problems, inference problems, and operator problems. These form the basis of the substantive critique. While no single problem is devastating to the logical system as a whole, the problems do lead one to believe that it is far from ideal, especially when trying to capture the complexity of natural language. The very fact that propositional logic stands up so well to systematic criticism displays its overall strength. But, is propositional logic the ideal or best logic to capture the meaning and relations of natural language?

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[63] Horn (2001:97–153) details other ways that negation – as “not” in natural language -- is different between predicate negation and whole sentence negation. For instance, Horn writes (1989: 142–143) writes there are at least eight different ways that negation functions. One in particular is that negation can both function as a truth-function of proposition, but also not as a truth-function when multiple values are involved. How the former is expressed, ~P is true iff P is false and ~P is false iff P is true, and the latter as ~P is true if P is true, false, or neither true or false. The contrast between the former and latter show how negation functions differently even than in the contrary example.

Systematically, as a symbolic logical system of relations and meaning, propositional logic stands in a much stronger light than it does as a system to inform about natural language meaning and relations. However, the larger problem is that propositional logic is used for that informative reason, which then places it in a position that its limited expressiveness and relevance is apparent. As this research concerns critical reasoning, the supposition that propositional logic is expressive enough, is undermined as the ideal tool for critical reasoning.

Propositional logic, through ECQ and EFQ, does not capture what is important about propositional logic inconsistency (contradiction) for critical reasoning: i.e. the detection of semantic inconsistencies and their relevance to the greater context. Pedagogically, using propositional logic confuses inference with implication. Inference is fundamental to critical reasoning courses; not so much for implication. While inference and implication are not mutually exclusive concepts, this chapter demonstrates that some have not understood the difference and in the process have failed to understand the importance of teaching inferential relations in natural language.[64] Critical reasoning demands emphasising this importance if practical reasoning skills are to be improved. It is trite, but true, but hypothetical syllogism and ECQ, are but two deductive implicative patterns that are taught and are limited in usefulness in everyday life. The results also confuse derivation for argument, which are distinct sets of relations. Why then take propositional logic seriously as a system of reasoning for everyday life? I submit that we should not, as this chapter has demonstrated the inherent flaws of propositional logic in this theoretical and ultimately practical capacity.

[64] The word “some” here refers to those who teach propositional logic as critical thinking, with no or little reference to informal reasoning and natural language emphasis.

Chapter 4: The theory and justification of the semantic conception of inconsistency

4.1 Introduction

In the previous chapter, problems were noted with propositional logic and its relation to natural language. Judgements of logical inconsistency, viz. propositional logic, draw their strength from formal contradictions. A statement and its negation fit a *formal pattern* that signals inconsistency. If the formal pattern is not present, another judgement follows from the opposing *truth-values* of a statement and of an opposing statement. Judgements of logical inconsistency then come from at least two sources, logical form or truth-values. Notice, however, the semantic notion of inconsistency, where semantic conflict between statements generates the inconsistency, is nowhere to be found in propositional logic.

This chapter will argue that both typical ways of judging logical inconsistency are not the primary determination of inconsistency in natural language. The primary determination is neither logical form nor truth-values but semantic, which is the primitive and natural way of assessing semantic conflict. This chapter articulates a novel theory of semantic inconsistency that gives due regard to ordinary inconsistency judgements. However, to demonstrate this theory, a detour through several concepts sets the stage for the understanding of semantic inconsistency in ordinary language arguments beginning, with some thoughts on *logica docens* and *logica utens*.

4.2 Logica docens versus *logica utens*

Peirce was an American philosopher, mathematician, and logician. While being famous for the pragmatist movement, later called "pragmaticism," his work on logic and reasoning is comprehensive and still relevant today. Not only did Peirce develop systems of formal logic, he also thought about reasoning in everyday life and its relation to theory. Peirce (1901:891-892) writes:

> “Every time a man really reasons, in that sense, he is clearly or obscurely conscious that his present inference belongs to a general class of cases in which an analogous conclusion might be drawn; and his approval of this reasoning consists in a belief that by acting on the same principle in all cases he will on the whole be advancing his knowledge more than by not drawing such conclusions. If this be true, as the reader’s self-observation may satisfy him that it is, a man cannot truly reason without having some notions about the classification of arguments. But the classification of arguments is the chief business of the science of logic; so that every man who reasons (in the above sense) has necessarily a rudimentary science of logic, good or bad. The slang of the medieval universities called this his *logica utens*, - his “logic in possession”, - in contradistinction to *logica docens*, or the legitimate doctrine that is to be learned by study.“

From the quoted paragraph, Peirce drew strongly on the medieval logical formulations of *logica docens* and *logica utens*. *Logica docens* concerns a theory of reasoning *per* rules and systematic application of those rules, which is taught through formal education, for example introduction to logic courses, critical reasoning courses, etc. *Logica utens* concerns our natural practice and habits of reasoning. As Peirce stated in the quoted paragraph, “… logic in possession …,” or what a human has in natural reasoning abilities (1981:892). In my opinion, the ordinary reasoning practices with natural language are the best representative of this concept.

One goal of this research is to extend the basic insights of *logica utens* to *logica docens*. But, in this extension, the former must inform the latter and content must be relevant and not suffer from the problems of propositional logic where the concepts do not carry over in a way that robustly makes sense of our natural reasoning practices. Thus, *logica docens* only tries to structure or inform *logica utens* to the degree it is an accurate representation of it. If formal logic has a role in critical reasoning, then this may be all there is to it in practice.

Returning to Peirce from the quoted paragraph, he is clear: reasoning should advance knowledge where drawing conclusions from reasons shows this practice (1901:891–892). It is not something that should be overlooked lightly. Reasoning is how one learns about the world and makes new knowledge claims about that world and human experience. Reasoning is also how one learns to critique the world. It is only on reflection and through education that one starts thinking about a theory of reasoning and why inferences lead to knowledge. The abstraction does not have to take one too far away from human reasoning practice. All it requires is that it can structure something about the practice to see if that structure holds in other cases. But structure must never dictate semantic content in ordinary reasoning as, the semantics are the conceptual connection between the basic structure of reasons and conclusions. So, a theory of reasoning (and not a theory of logic) must contain an articulation of the priority of semantics over syntax, and something about argument structures of connections that support this priority.[65]

4.3 What is critical reasoning?

A simple search of "critical reasoning", yields many complex definitions that try to cover all relevant cases, and if the search extends to its American form, "critical thinking," even more definitions follow. Consideration of a few definitions show the range of the concepts:

> a) "Critical thinking is the intellectually disciplined process of actively and skillfully conceptualising, applying, analysing, synthesising, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness" (Scriven and Paul 1987).
>
> b) "… we have focused on the two arms of critical thinking: assessing others' reasoning and presenting reasoning of our own" (Groarke and Tindale 2012:340).
>
> c) "Critical thinking may be taken as the art of assessing truth claims according to certain general principles or canons" (Dauer 1989:3).
>
> d) "Critical reasoning is active, reflective, and informed thinking that involves the ability to deliberately and skillfully question, analyse, interpret, and evaluate ideas and beliefs in the light of the reasons, or evidence, which support them" (Van den Berg 2010:3).

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[65] Peirce (1901:891–892) is important to the conceptual foundations of this thesis by way of his articulation of *logica docens* and *logica utens*. By making this distinction, he opens it for consideration of which one should inform the other, if at all. Reasoning may have little to do with formal logic in the sense of *logica utens*, for what reasoning skills do we possess naturally and how can we utilize them most efficiently? This thesis takes *logica utens* as the primary concept from which *logica docens* is derived. Of course, this is a limited view and Peirce may be wrong, for instance, there may be a hybrid of the two that functions effectively, which seems to be what philosophers like Poston (2011) try to do. Finally, intuitively, it seems to me that Peirce is just denoting the very distinction between implication and inference that Harman (2002) makes and this thesis utilizes, i.e. *logica utens* is inference and *logica docens* is implication.

> e) "The first thing to get straight in thinking about thinking is the difference between questions about validity and questions about truth. But in getting this straight we shall find that we are sorting out every other really fundamental notion" (Flew 1989:11).
>
> f) "… the evaluation of ideas (critical thinking) accomplished by narrowing your focus, sorting out the ideas you've generated, and identifying the almost reasonable ones" (Ruggerio 2009:16).
>
> g) "Critical reasoning as we conceive it is both active and open to alternative points of view. We can describe our approach more clearly by contrasting it with two other kinds of activity: (1) passive reading or listening (as in the case of students who expect a lecturer to fill them with information) and (2) mere disagreement (as in the case of a combative person who is not willing to take seriously the reasons and opinions offered by other people)" (Cederblom and Paulsen 2005:2).

Definitions (a) and (b) highlight the vast difference in conceptions of critical thinking. Neither is inaccurate, especially if the focus of critical thinking is reasoning, particularly the practice of giving and considering reasons of others. The problem with definition (a) is that it stands in need of an explanation itself given its vast detail. Students without a background in critical reasoning would likely have problems understanding the proper intent of the definition. Consider "clarity" and its use in the definition. What is "clarity?" How does it relate to "precision" and "accuracy?" Clear concepts are typically precise and accurate, in fact, it is opaque as to how a clear concept could not be precise and in the process still be accurate, supposing precision and accuracy both have the same normative component of application. Definition (b), while austere, is more likely intuitive to the student of critical thinking because it focuses on the practice of giving and receiving reasons for a view, something done in everyday life. From that basic definition, other concepts like "evidence" and "fairness" make more sense when brought in, as they work in a suitable context.

Definition (c) highlights a typical confusion with critical thinking. It places truth-values at the centre of dispute. If the goal of critical thinking is ascertaining truth-values, it supposes that knowing truth-values for all claims and adopting the right reasoning practice, leads to truth. Critical thinking in practice may not yield truth-values; all it may yield is understanding of an issue. The normative component of truth-value assessment comes after understanding an issue. Even the typical deductive picture of validity and soundness supports this order, where structural assessment comes first and may never reach the semantic assessment of the relationship to the world or other ideas. This is not to say that truth is unimportant and should not be sought, as it obviously is important. The point, however, is that a project of critical thinking that compels truth determination and not understanding will fall short in practice and is likely too lofty.

Definition (d) includes the very important concept of “reflection.” Critical thinking involves reflecting on one’s own situation toward others, and their relations to each other as well. The concept of reflection, largely due to self-consciousness, enables us to ponder our individual views as one of many views in life. The tendency to abstract and isolate one’s own views is only valuable when those views are set in a broader context of multiple views. The concepts of “evidence” and “reasons” gain traction from their shared understanding, as does the content of the concepts in the appropriate contexts.

Definition (e) places critical reasoning into the domain of traditional logical evaluative concepts. Flew holds that structure (validity) and semantics (soundness) taken together properly sort out the domain of thinking (1989:11). The difficulty with his approach is that it sets aside a whole domain of arguments that are deductively invalid, yet can still be true, justified and persuasive as Russell (2009:71) argues.[66] This definition has a similar tone as definition (c), relying on structure or general principles to transfer the truth from the premises to the conclusion. In contrast to definitions (a) and (d), definition (e) is seriously limited and does not have the necessary scope for the practice of critical reasoning.

Definition (f) is a practical definition that does not allude to argument structure like definition (e) or truth like definition (c). Figuring out which ideas are reasonable in the current context are extremely important in everyday life. We naturally narrow down ideas into two sets; reasonable ideas and those that are not. There may be grey areas where more work needs to be done, but on the fly,

[66] Russell writes in *The Problems of Philosophy*, “Hence we shall reach the conclusion that Socrates is mortal with a greater approach to certainty if we make our argument purely inductive than if we go by way of 'all men are mortal' and then use deduction” (2009:71).

when assessing ideas, reasonable ideas are extremely important. In our day, with the onslaught of information at our fingertips, what counts as “reasonable” has been under attack, which also relates to narrowing down ideas. While this definition lacks important components found in (a) and (d), it articulates a practical view of the daily practice of critical reasoning.

The final definition (g), uses contrast to help understand the domain of critical reasoning. Critical reasoning is an active process that is open-minded to alternative views. This definition implies reflective engagement of the views of others, with the potential and willingness to adopt another view. This definition also contrasts with passive processes of reading and simple disagreement, where one fails to resolve or attempt to resolve the contention. What the definition misses is that passive processes, typically, are unreflective and both reading and simple disagreement show a lack of reflection. The missing grounding of both, thus, is reflection and must be part of any critical reasoning, as definition (d) made clear. Active engagement requires reflection.

It may be better to say, for the purposes of focusing on the activity of what we do, that “critical reasoning” is *an activity where reasons are given and understood for a precise purpose to achieve some particular argumentative or evidential end*. Reasons can be given to oneself in an internal dialogue; reasons can also be given to other people in an external dialogue. In both cases, the purpose might be to understand, both for oneself and to others. The purpose could also be to demonstrate the degree of evidence one has for a belief. And, there are many others bound up in this activity including truth-value determination.

It is common to associate critical reasoning with persuasion, or trying to motivate someone to believe the way that you do about an issue or situation. Persuasion may lead to fallacious reasoning in an effort to be successful without respect for truth. One example of using fallacious reasoning to persuade is in the legal field, as Saunders (1993) details. In particular, Saunders gives examples of the *ad hominem* fallacy (1993:346 & 348), the appeal to pity (1993:348 & 349), and the appeal to authority (1993:353—354). Saunders is fair in his assessment as sometimes fallacies are noted by the court and the argument rejected

(1993:347,352 & 355). In the cases referenced, fallacies were allowed. One might then question whether the outcome would have been different in terms of truth had the fallacies been halted?

But, persuasion is not the only significant element about critical thinking, and frankly, it may not be as important as “understanding.” Persuasion is tricky and may not be achievable with controversial topics like abortion, gay rights, and other complicated political issues. Fundamental differences in worldviews may be too much for any reasoning to bridge. So, it may be that understanding the contentious issue is all that is achievable: understanding should always be the primary goal, with persuasion secondary.

The focus on “understanding” is a key point and serves as a basis for a general line of thought of this thesis. In critical reasoning, little may be known about the truth-value of claims at the time of reasoning, and may never be known. For instance, one cannot know if Lee Harvey Oswald was the sole shooter of President John F. Kennedy. However, one can understand that a “sole shooter” contrasts with “multiple shooters” and that would matter to evidence found for either claim.[67] The truth of the claim “Lee Harvey Oswald was the sole shooter of John F. Kennedy” may never be known. Critical reasoning about this issue would not be a failure if the truth was never known as there may be a greater general understanding(s) of the event, but those who place truth determination as the most significant component of critical reasoning might surmise it a failure.

Critical reasoning is something that we do as humans. It is not a passive process where it happens to you; you must initiate it when the need is plain, and a comprehensive education emphasising critical reasoning can make the process more effective and rewarding.

[67] This is one example of gradation, which will be discussed later in the chapter.

4.4 Natural language arguments

In chapter two on propositional logic, logical implications were symbolised from natural language into the logical language, and manipulated *per* learned systematic rules. To achieve the correct implicative result, the proper rules must be used competently. Thus, in using propositional logic, one must be reasonably well versed to use it effectively.

Natural language arguments, on the other hand, do not require any special competency for effective use. In fact, we use these arguments from a relatively early age and do so effortlessly. The limits of natural language arguments and reasoning skills are usually only tested when we reach our competency limits in controversial cases where basic worldviews are not shared. In fairness, it may be too much to ask of any argument to settle such cases, as they likely have little to do with the argument itself. Instead, the presuppositions involved control the direction(s) of the argument and are likely irreconcilable without someone giving up fundamental beliefs. Thus, the effective reach of natural language arguments is suitable for areas where a direct challenge to presuppositions do not manifest.[68]

4.4.1 Structure

Natural language arguments consist of a basic structure where one or more ideas follow from a group of other ideas. “Conclusions” are the ideas that follow from “reasons.” Putting reasons and conclusions into a vertical structure shows the inferential relationship between the two groups of ideas, such as:

[68] A recent study by Kaplan, Gimbel and Harris (2016) demonstrates that deep-seated political beliefs are likely tied to the emotional aspect of the brain and its processing. Whether this will be borne out as fact, in time, it does explain the impotence of reasoning in such cases, where deep disagreement cannot be bridged.

The car did not start.
The lights did not turn on.

Thus, I think the battery is dead.[69]

The ideas above the line are the reasons and the idea below the line is the conclusion. The line marks a separation of ideas and in a sense, indicates that inference is going on. “Inference” simply means that from believing one group of ideas, then believing another idea(s) follow. About a car problem, when a car does not start and the lights do not work, it is likely the battery is dead. These are beliefs generated by the context. However, given the argument is not a valid deductive argument where the truth of the premises necessitates the truth of the conclusion, believing other ideas or conclusions can follow. For instance, there is an electrical short in the system. So, the argument would be:

The car did not start
The lights did not turn on.

Thus, I think the battery is dead.
-or-
Thus, I think the car’s electrical system has a short in it.

Given the limited scope of the reasons, no single conclusion is decidable without more evidence provided through more reasons. Imagine, after opening the hood of the car, discovering the battery is a 72–month battery with no change in 80 months. The argument would then be:

The car did not start
The lights did not turn on.
The battery is eight months overdue for replacement.

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[69] I am not using “∴” here on purpose. The triple dot symbol is used in the previous chapter and elsewhere to indicate implication, not inference. So, arguments without “∴” are inferential, not implicative.

Thus, I think the battery is dead.

-or-

Thus, I think the car's electrical system has a short in it.

The basic structure of argument and inference in everyday life is a relationship between reasons and conclusions, and the plausibility of the relationship between them given the context. A change of context might impact the plausibility of the relationship. Suppose, the car model has a known electrical defect that mimics the problems the car is having. More investigation would be in order potentially minimising the battery replacement. To this end, argument and inference in everyday life are dynamic.

However, that dynamic nature is often static when considering the written word, and a good deal of our argumentative education focuses on constructing arguments from this source. The argument is a snapshot in time. Critical reasoning courses by their nature emphasise the written word and textual analysis. And, to slide back to the slippery road of propositional logic, it would be the rare case where someone translated an argument into symbols in an ordinary context outside of a logic course or philosophy course. Thus, the written word is foundational to learning about argument formation and schematisation.

There is something that is likely inarticulable in a robust fashion but is worth mentioning. Teaching inference is difficult, but students typically have that ability in varying degrees, coming into any course.[70] There is a basic inference ability such that a student must have to even get to class through figuring out a map of the campus, time to be there in the schedule, room location, and where to park, to list a few. This ability is probably due to complex factors including history, comparing and contrasting past instances to the present one, general understanding of how the world works, and competency in one's primary language. The more difficult kind of inference to teach is from complicated

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[70] A lot of "showing" goes on in courses with arguments, as students see the relationship through examples. Thus, they do not learn inference in any real sense. What students see are examples of inference and apply that to their lives. Even the vocabulary is a visual one, as the following example illustrates: "seeing the connection between the reasons and conclusions."

scenarios where the student does not understand what to infer from what, in short, they lack among other things, the ideas of relevance, what counts as a “reason,” and context. The inference tends to be subtle in many instances. Thus, what follows about identifying reasons and conclusions should be set in that context.

4.4.1.1 Identifying reasons and conclusions

What is a “reason?” It would be helpful if there were a simple answer to that question. The problem with identifying a straightforward answer is that the concept of a “reason” does not stand by itself. A reason only makes sense in the offering for another claim, a conclusion. In this relationship, a reason is something that helps one believe, understand, explain, and/or accept a conclusion. In the previous example of a car not starting, the reasons support the conclusion that the battery is the problem. More reasons, taken together as a group, would potentially support the conclusion even more strongly, which then manifests in a better overall argument. A reason is also part of human intentionality: it is something that is part of human life and works in simple and complicated ways. Humans, would not be who we are without the reason giving process, which allows questioning and learning more about the world. So, what a “reason” is, is not so straightforward to define, but we use them daily as part of our form of living.

Nevertheless, while there is not a clear definition of a “reason,” there are ways to identify reasons within a text. One basic formulation uses the subordinating conjunction of “because.” Consider the form “x because y”, “x” is the conclusion, “y” is the reason. Schematised in a structured argument form this becomes:

$$\frac{y}{x}$$

This structural element only displays when one schematise’s the argument; however, in reading a text, the important aspect is that which follows the word “because”, which may be a reason. There are some cases where the “y” position is a cause, for instance: “The ground is wet because it rained”, “y” is the cause and “x” is the effect. Structurally, however, it provides students with a detector when the reasons are not clear during the schematisation process. Other words that may signal a reason include: “for,” “after all,” “due to,” and “in as much as.”

If the reason indicator words are not present in the text, and one has a good idea of what the conclusion(s) might be, those relevant reasons that impact that conclusion should be included in the argument schematisation. Simply, a reason must manifest in some inferential relationship with a conclusion to be relevant to the argument. In the previous argument, the car not starting is relevant to the battery being dead, as is being beyond the effective date of battery usage. The car not starting is also relevant to there being a short in the electrical system, but the effective date of battery usage is not. In this way, the reason is connected to one conclusion but not another, which still shows it is relevant to the argument and should be part of the schematised argument. It is worth noting that reasons are not thought about without relation to a conclusion, so the latter concept needs some attention as well.

Conclusions are easier to identify due to the way texts are written. Like the reason structure found in the word “because”, the conjunction “so” functions for conclusions. Consider the form “x so y” where “x” is the reason and “y” is the conclusion. Schematized into a structural form this becomes:

$$\frac{x}{y}$$

Not all cases of the structure have “x” as a reason. “X” can be a causal element in a ramification, such that “The car is on fire so we must walk home.” “The car is on fire” is the cause of them walking home. Structurally, however, it provides students with a detector when the conclusion(s) are not clear during the schematisation process. Other words that may indicate a structural conclusion include: “thus,” “therefore,” “since,” and “hence.”

There is another group of words that when found in a text might indicate a conclusion, words such as “may,” “might,” “must,” “probably,” “implies,” “thinks,” “believes”, and “suspects” to name just a few. Other words that can indicate a conclusion are normative terms such as “should,” “ought,” “duty,” and “permissible.” These words, and others, may occur in the conclusion itself and indicate inference. For example:

> Wreckage from a Boeing 757 was found on beaches in Mauritius and Mozambique.
> Flight 370 is missing.
> Flight 370 is a Boeing 757.
> No other Boeing 757s are missing.
> ____
> Thus, I believe the wreckage is from Flight 370.

Note the structural conclusion indicator of “thus” and the conclusion indicator of “believe.” This is an argument because of the indirect nature of the conclusion. The only reason we know the person believes the wreckage is from Flight 370 is through the reasons; otherwise there is no basis for believing in the conclusion. Indirectness is a clear sign of inference.

The previous argument includes two conclusions as possible inferences from the reasons. Multiple conclusions, whether explicitly stated or not, are common to our ordinary reasoning practices. Rarely, as in the car argument, do we think there is absolutely *one* thing wrong with the car from the outset. Another example is going to the doctor. While we might have an idea of what is wrong, we are open to other possible diagnoses that follow from our symptoms. It is only when we use the propositional (or syllogistic) model of argument that we think that entailing one conclusion is necessary.

In our ordinary reasoning practices, we use comparison and contrast to help us figure out what conclusion to believe and why. One of the easiest ways to understand what counts as the right conclusion to an argument is to also understand what counts as the wrong conclusion to the same argument. Sometimes the contrastive conclusions are in the text itself, but at other times, we might have to create them on our own to display the necessary contrast for understanding. What is interesting is how this contrastive conclusion understanding is tacitly in place when reasoning in ordinary, non-textual, contexts. Often, the contrasting conclusions are thought of and not brought up until the right time, but they likely work in the same way for us.

To this end, finding contrasting conclusions in the text at hand through the indicators mentioned above, or conclusions needing to be generated from the context issues from what counts as a plausible conclusion from the context. If the generated contrasting conclusions meet the requirement of having one or more reason(s) relevant to them, they are acceptable to demonstrate the contrast. For example, in the car argument, almost any generated conclusion that is a car problem may be relevant in the right way. This relevancy of reasons to conclusions, grounds the inference process.

Identifying ordinary language arguments, in texts, occurs in a few ways by noticing relationships between supporting ideas and concluding ideas, and reason and conclusion indicating words. This identification, however, does not stand alone as reasoning is part of one’s life, where history, education, and context all influence forming and understanding arguments.

4.4.2 Lack of logical vocabulary: if-then, all, some, and no

In the propositional logic section, the logical vocabulary of conjunction (and), disjunction (or), conditional (if…then) and negation (not) was manifest in the particular symbols chosen. The translation from natural language to the logical language was the first step in assessing the argument in propositional form. Syllogistic logic, like propositional logic, has its own vocabulary too, where “all,” “some,” and “no” function in relating groups. Between these two systems of logic, there is a “definite logical vocabulary” at play in natural language translation and the subsequent argument formation.

When performing textual analysis to schematize arguments, it becomes apparent to the trained eye that the "definite logical vocabulary" is not found in any robust form. Most natural language arguments involve sentences without logical connectives. For instance, reasons are often stated in a single sentence and not conjoined with "and" or other conjunctions. The same holds for disjunctions, as they are usually separate sentences. Of course, there are examples of conjunction and disjunction in natural language arguments but they are not the norm. The conditional might be more common, but the question would be if the hypothetical is relevant to the argument. The conclusion entailed by the conditional may have more promise as a reason or conclusion, but the conditional not so much. The syllogistic language of "all," "some," and "no" is equally fleeting in textual analysis as exclusive terms, namely, "all" and "no," do not articulate our much less rigid human experience. "Some" occurs more frequently, but there is a further problem with syllogistic statements: they are of a logical form. For example, all A is B, some B is C, no A is B. There is minimal common usage of these forms as sentences in English. Instead they are logically constructed sentences suitable for logical manipulation.

Once again, this is not to conclude the terms do not occur, but their instance is occasional and not enough around which to build a theory of critical reasoning. In a typical investigation, "Some of the witnesses saw…" is a common use of "some" or "no further information was given…" is a common use of "no." "If—then" can be used in causal contexts where the antecedent is a necessary condition of the consequent, "If he shows up, then he will be fed." But, these cases and others like them are limited and cannot justify building a theory of reasoning around them.

If the thoughts on the "definite logical vocabulary" are correct, they imply at least one main thing. The "definite logical vocabulary" is not common in textual analysis, and thus constructing natural language arguments in a straightforward way with that vocabulary is not done with any regularity, if at all. The "definite logical vocabulary" is a caricature of the vocabulary of reasons and conclusions in natural language not only in the written word, but with the spoken word as well. Instances of syllogisms in ordinary life are rare, as are propositional arguments.

The practical disconnect between the “definite logical vocabulary” and forming natural language arguments is substantial.

4.4.3 Erotetic and interrogative context

Erotetic logic focuses on the relationship between questions and answers in a formal context, they lead from reasons to questions or questions that need an answer. Harrah (1961:40–46) and Wiśniewski (1991:261–263) are two notable logicians with substantive thoughts on the matter. While there are differences between these approaches, what is worth noting is that both prioritise the role of questions in reasoning. In critical reasoning, the general idea of interrogative context aligns with the ordinary language approach to reasoning. Interrogative arguments are those based on a question and answer model without translation and symbolic formation of the argument. Thus, the interrogative context is the one important to the concepts here.

Wright (2001:139–233) uses an interrogative approach to critical reasoning. Dixon (2017:32–39 & 86–89) follows Wright’s basic interrogative structure, but modifies the apparatus to make it more accessible and effective for students.[71] Neither Wright nor Dixon work from reasons to questions, but instead use questions with reasons to reach the correct conclusion. Dixon (2017:32) calls this the “ADM” for “analytical defeasible model of argument.” This model integrates questions and answers into the basic argument structure. The ADM in form is:

Reasons

Context Question
Competing Conclusions

[71] I make no claims to be the originator of the interrogative model of argument in Dixon (2017). I use Wright’s ideas and conceptual structure, but simplify it by changing vocabulary, reworking the structure, and setting it in the proper context of erotetic logic and inference to the best explanation. Wright’s ideas arguably owe their intellectual heritage to Scriven (1976).

The reasons recommend the best conclusion as the right answer to the context question. The competing conclusions must answer the context question directly. For instance:

R1: The car did not start
R2: The lights did not turn on.
R3: The battery is eight months overdue for replacement.

CQ: What is wrong with the car?
CC1: I think the battery is dead.
CC2: I think the car's electrical system has a short in it.

CC1 directly answers the CQ, as does CC2. However, in looking at the reasons, the reasons support CC1 being the right answer. So, the reasons, R1–R3, directly relate to the likelihood that CC1 is the right answer to the CQ. In ordinary use the conclusion is just the answer to the question asked.

Formulating the context question in the right sort of way is important. Interrogative words such as "who," "what," "when," "where," "why," and "how" broaden the range of answers. Words such as "did," "is," and "was" limit the range of answers to two or three, and that is not desirable. Instead, all legitimate answers should be available to the question, even those that do not appear in the text or are not a part of the initial conversation. To see a clear case of a context question that opens up multiple answers, consider a criminal investigation into a murder case. An obvious start is the asking of: "Who killed this person?" Anyone who was in the area is technically a suspect, even those whose involvement is questionable. Reasons through evidence like eyewitness testimony, DNA, and other means eventually narrow down the list of suspects and if the investigation goes properly, it leaves one suspect as the right answer to the context question. Sometimes, however, new evidence emerges allowing the release of the initial suspect and another person on the list becomes the primary suspect. By choosing the appropriate interrogative word, no suspect was excluded and the investigation was fruitful.

Natural language arguments in practical contexts are part of a questioning and answering process. Something comes up missing, “Where is my phone?” and an inquiry starts. I start thinking through where I had my phone last, ask my wife if she has seen it, etc. This questioning gives me reasons to conclude I either left it at my office or it is in my vehicle. A developmental point must be made as well. Children are taught to question as a part of growing up. Early questions – for example, “where is mother?”, “what are we eating for dinner?”, the basic yes/no questions “can I stay up late?”, etc. – form a major part of the discourse and instruction of a child. This natural part of our reasoning activity, thus, should be one that is not only recognised but exploited in our critical reasoning practices throughout life.

4.4.3.1 Using questions to set context and relevance

It is crucial to understand that in critical reasoning, context and relevance take on a hyper-significant role. It is a shame not more is said about these concepts, but that is probably because they are a “given” and obvious to some people. Sadly, it is not that obvious to all involved in discourse. One way to correct some of these contextual and relevancy issues is to focus on questioning. When questioning correctly, it sets the proper context for argument and relevance of reasons to conclusions. Learning to question correctly is a skill that can be taught to some degree, but even it relies on one understanding the relevance of the argument to the specific and general contexts.

When arguments do not have a context question, they implicitly rely on one, as the argument schematisation itself is significant. The person putting forth the argument assumes the argument is worth considering, but this is another example of argument abstraction from the specific context. This abstraction is likely the result of a misguided pedagogy where abstraction aids understanding.

Using context questions allows for two senses of evaluation: internal and external. An internal sense of evaluation allows for the questioning of proper reasons and their relationship to the conclusions:

- Have the right reasons been chosen to plausibly support the conclusion(s)?
- Do the conclusion(s) make sense given the argumentative context and are they related to the reasons?

An external sense of evaluation allows for questioning whether the context question is the right question for the inquiry, and if the context question and resulting argument make sense with the general understanding of the way the world works. The external sense of evaluation continues emphasis on the role of context and relevance through grounding the argument in our ordinary reasoning practices and life.

4.5 Identifying inconsistency in natural language arguments

Natural language arguments can be consistent or inconsistent. “Inconsistent” means that there is some sort of conflict between the reasons or the reasons and the conclusions. The conflict makes accepting the argument not as straightforward as if it were consistent, but it is not necessarily problematic either.

Consider an article about a controversial death (Milanes 2016):

> “SAN DIEGO -- A Federal judge will decide next week whether one of San Diego County’s most infamous cases deserves a civil trial.
>
> On July 13, 2011, 32-year-old Rebecca Zahau was found naked and hanging from the second-story balcony of the Spreckels Mansion in Coronado.
> Two days prior, on July 11, Max Shacknai, the six-year-old son of Zahau’s millionaire boyfriend Jonah Shacknai, fell down some stairs. He died three days later in what was considered a freak accident. At the time, he was under Zahau’s care.
>
> After a months-long investigation, the San Diego County Medical Examiner and San Diego County Sheriff’s Department ruled Zahau’s death a suicide. Zahau was found with her hands and feet bound behind her back with red rope. Her mouth had been gagged. Investigators said she then hopped over a balcony and hung herself. But Zahau’s family refuses to believe she took her own life. They hired attorney Keith Greer to prove she was murdered.
> Greer believes that Adam Shacknai, Dina Shacknai and Nina Romano were behind Zahau’s death. Adam is Jonah Shacknai’s brother. Jonah is a wealthy Arizona businessman who was dating Rebecca. Dina is Jonah’s ex-wife. Nina is Dina’s twin sister. Max was Jonah and Dina’s son.

In July 2013, Zahau's family filed a $10 million wrongful death lawsuit in Federal court against Dina. Also named in the lawsuit were Nina and Adam. Jonah was not named.

Greer alleges their motive for killing Shacknai was revenge for the accident in the mansion that killed Max, on Rebecca's watch. Greer believes that Rebecca was strangled to death before she went over the balcony.

"When a person is hung, the rope is up here, on the upper part of the neck," Greer told 10News. "That cartilage was down here, at the base of the neck. So, that cartilage is more consistent with a strangling type of death."
Police investigators said Rebecca wrote a cryptic suicide note on a door with a paint brush and black paint that said, "She saved him can you save her?"
Greer hired a handwriting expert. According to Greer, the expert determined the note was likely written by a right-handed male. Based on how high the door was, the person was probably six-feet-tall. Rebecca was only 5-foot-3. Greer said he discovered that that Adam Shacknai was the only man at the mansion at the time of Rebecca's death.

A hearing in the civil suit was scheduled for Friday afternoon in U.S. District Court in San Diego. However, the hearing was delayed to Feb. 26. At the hearing, a judge will decide whether there is enough evidence to send the lawsuit to trial."

This article has a wide-ranging argument in it, which the ADM schematises as:

R1: Investigators say RZ bound her own hands behind her back and legs, and gagged her mouth.
R2: Investigators say RZ wrote "She saved him, can you save her?"
R3: Investigators say RZ jumped over the rail on the balcony and hung herself.
R4: Zahau's family lawyer says what was written in R2 is at the wrong height for RZ.
R5: Zahau's family lawyer says male at the home was the right height for what written in R2.
R6: Zahau's family lawyer says handwriting analysis indicates what was written in R2 was written by a male.
R7: Zahau's family lawyer says damage to RZ's neck was due to strangulation given the location on the neck of cartilage damage.
R8: Max Shacknai (MS) died while under RZ's supervision.
R9: The family was very distraught including MS's mother, her sister, MS's father, and his brother, the male who was at home.

CQ: What happened to Rebecca Zahau (RZ)?

CC1: RZ committed suicide.

CC2: RZ was murdered (strangled).

CC3: RZ died of natural causes.[72]

Schematizing the totality of reasons includes two accounts that produce the conflict, which manifests in conflicting conclusions.

A few things to note about this article and argument schematisation.

1) The inconsistencies in the story are not formal contradictions. There is no explicit negation of a claim, nor is there a conjunction of them. The only way you generate that sort of inconsistency is by doing “two-step” translation where, for instance, suicide means “not murdered,” and thus forming the contradiction of “murdered” and “not murdered.” But this “two-step” translation is an *improvised* move to fit concepts of an argument into concepts of a logical system, which may be a specious move.

   An analysis of the reasons in the RZ argument demonstrates that R1 and R3 conflict, it is hard to jump over a balcony rail when your feet are bound. R2 and R4 clash due to RZ’s height; R2 also conflicts with R6 because of the difference in sex. R3 and R7 diverge greatly due to the type of damage. All the conclusions are semantically incompatible, which, when formed properly also exhibits the logical property of being mutually exclusive.

2) A further analysis of the reasons and their relationships to the conclusions reveals two different accounts. The overlapping reasons R1, R2, R8, and R9 are consistent with both accounts. R3 is consistent with CC1 but inconsistent with CC2. R4–R7 are consistent with CC2 but inconsistent with CC1. CC3 has no relationships with the reasons but does contrast with CC1 and CC2.

[72] The numbering of the conclusions is not a ranking; CC1–CC3 are labels to allow discussion of them. CC3 was added to show contrast, but will be dropped in further uses of this argument.

Given the ADM's structure, inconsistency is at the heart of an inquiry. Understanding the right answer to the context question also involves understanding the wrong answer. Understanding how particular reasons support one conclusion over another includes understanding those reasons that do not support a different conclusion and conflict in varying degrees. It is important to grant that the article provides here as an exemplar is not a caricature found in a critical reasoning textbook, rather it is an actual article containing an argument challenging the "official" story. The article works well with the ADM due to being an inquiry.

4.5.1 Order of recognition

In the RZ article, and consequent schematising of the argument and analysis of its relations, there was no mention of truth-values, as those values are the contentious issue in need of resolution. Unfortunately, the argument presented in the article only went some ways toward resolution but not far enough.

Recognising semantic conflict takes priority over knowing truth-values in most critical reasoning arguments, because understanding the semantic conflict precedes evaluating that content for a logical truth-value. This order of recognition might seem like much ado about nothing or an obvious point, but it is foundational to my argument. Teaching inconsistency judgements, from the perspective of formal logic, relies on truth-value recognition, such that both claims cannot be true at the same time and in the same sense, i.e. the LNC from Aristotle. This "idealised" form of inconsistency supervenes on the natural language conflict. One has an idea of the ideal form and forces the semantic inconsistency into the form, regardless of its natural fit. But that is not the only problem. This direction of understanding seems to put the proverbial cart before the horse by supposing it is a precise form or type of inconsistency, which is likely the result of assuming a flawed pedagogical attempt in a critical reasoning course.

In the next section, further semantic conflict types are articulated, which demonstrates, from the perspective of this section, that forcing logical form on semantic inconsistency is done *ad hoc* and without contextual sensitivity to the semantic conflict.

4.5.2 Conflict types in natural language

There are at least three different conflict types in natural language: explicit negation, implicit negation, and contextual mismatching.

Explicit negation is a direct conflict with the same sentence or idea purposely negated. For example, “The Earth is a planet” and “The Earth is not a planet.” As the label indicates, there is an obvious use of “not.” The actual amount of explicit negation that occurs in natural contexts is minimal at best, except with someone denying a claim in a “…that’s not true” type of interaction.[73]

Implicit negation is more common but not as transparent. An example of implicit negation from the RZ article is the conflict between the conclusions of “suicide” and “murder.” Previously the “two-step” translation was put forth. Implicit negation in recognising the first step leads to, or entails the second step but the second step is not put forth in translation. Competent language users know that “suicide” and “murder” are inconsistent with one another without changing “suicide” into “self-murder.”[74]

Contextual misalignment is another source of plain conflict. When either implicit or explicit negation is present, for it to be that respective type, it must be in the same context. However, if either form of negation is present and the context is different, it is not obvious that there is a legitimate conflict between the claims. This type of conflict can be subtle, but the point is that on further analysis the conflict is not a legitimate one. An example of this conflict can be found in Williams’ (1993:20–25) work on relativism, where he argues:

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[73] Depending on the number of truth-values, “not true” is not an explicit negation in a three-valued logic where “not true” can also mean “indeterminate.”

[74] “Self-murder” is one interpretation of “suicide,” which would still conflict in the right way with “murder by another person(s)” if someone wants to reinterpret “suicide” in that way. But that is still a “two-step” move and undermines the original language.

1. "'Right' means "right for a given society."
2. 'Right for a given society' works in practice for that society.

Therefore, it is not right for one society to criticize or involve themselves in the values of another society because it is how that society functions."

Williams argues for the presence of the fallacy of equivocation: "right" in the premises is being used differently than "right" in the conclusion (1993:20). "Right" in the premises is being used as relative to a society; "right" in the conclusion functions in a general sense, not in the relative sense of the premises. (1993:20–21). This shows a contextual mismatch between the two senses in a standard schematised argument. The same thing may occur in a dialogue about relativism without the schematisation.

There are other conflicts in natural language; however, they prioritise truth-values over semantic content for understanding: contradiction, contrary, and subcontrary.[75] These conflicts manifest in Aristotle's square of opposition from *De Interpretatione* (1963:47–68), which aids in the explanation of these concepts. A contradictory pair of statements is "all men are mortal" and "some (not all) men are not mortal." Only one of these statements can be true. A contrary pair of statements is where both statements can be false but both cannot be true. "All men are mortal" and "no men are mortal" demonstrates the pair can be false, supposing "some men are mortal" is true. Finally, a subcontrary pair of statements is where both statements can be true but both cannot be false. "Some men are mortal" and "some men are not mortal" displays that the pair can be true.

In fairness to Aristotle, he had logical reasons for the square of opposition and working out logical statements in particular ways because of the broader context of syllogistic logic (1963:47–68). But, setting that aside, there are a few things to ponder about the relationships put forth. In a previous section, it was contested that "all," "some," and "none" occur with regularity in natural language arguments that are subject to critical reasoning standards. In syllogistic logic,

[75] "Contradiction" here is different in meaning than under propositional logic where there is a conjunction of two opposing statements. It is not clear what Aristotle had in mind in conjoining the statements; instead, semantic conflict is explained in terms of different truth-conditions for statements.

these terms are foundational; in everyday reasoning, they are not. More so, at least for this thesis, the statements show varying types of conflict, such that “all” and “some,” and “none” and “some”, conflict in a way to draw attention to the tension, regardless of the truth-value. Contradiction, contrary, and subcontrary, as set up by the square of opposition, already have the truth-values determined in one sense. But, as it goes in critical reasoning, this set truth-value determination is often not the case.

Normally, the statements in the square of opposition have an ordinary understanding, but what about the following subcontrary pair: “some Martians are blue” and “some Martians are not blue?” Subcontrary statements can both be true, but not both false. Both statements are false, however, because Martians do not exist to have any predicated property, “blue” or otherwise.[76] The lack of carryover from the semantic conflict to the truth-values is revealing about the applicability of the square of opposition to all types of statements, both those implying existence and those that do not. Nevertheless, the two statements' logical forms imply some form of conflict. This formal conflict is important in assessing inconsistency in any sense because of its basic conflicting relationship that is easily recognised as a non-implicit form of negation. This recognition even when a hypothetical one, such that Martians are blue, might be the only way these two statements make sense together. How do they make sense? They make sense in contrast to each other since neither exist or refer in the ordinary sense.

In this section, types of semantic conflict were noted and articulated. These ideas of conflict relied on recognising the difference between implicit and explicit negation. Contextual mismatches which appear to give rise to conflict were also noted. In the next section, a robust theory of semantic inconsistency detailing conflict is articulated.

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[76] I am aware of the idea of “existential import” where a claim has to refer to an existing class of things, but as Russell (1905:398–401) notes “existence” has different meanings. A theory of logic should handle all kinds of existence, if existence is universal.

4.6 Semantic account of inconsistency in ordinary language

In this section, the theoretical underpinnings of semantically inconsistent judgements are put forth. After beginning with a definition of "semantic inconsistency," a conceptual theory of antonym function follows explaining how many semantic inconsistencies arise. After explaining the standard lexical-categorical approach, it is rejected. From there, applying the resulting supported antonymic concepts from the conceptual theory results in a different understanding of inconsistency in practice, by way of natural language arguments.

4.6.1 Defining "semantic inconsistency"

To this point, "inconsistency" has been approached in many ways. A good deal of effort has been spent on the logical side including both formal, e.g. propositional logic, and informal accounts, for example, square of opposition and its three concepts. In some of the discussion, the notion of "conflict" was put forth to articulate an initial attempt at focusing on what is apparent and important. Dictionary.com (2016b) defines "inconsistency" as: "1. lacking in harmony between the different parts or elements: … 2. lacking agreement, as one thing with another or two or more things in relation to each other; at variance ..." Two important concepts emerge from these definitions, "harmony" and "agreement". Consistency is a harmonious relationship bearing agreement among ideas. Inconsistency, then, is a relationship that lacks harmony and/or agreement among ideas. The formulation and use of a definition of "inconsistency" from common usage is very important. If critical reasoning uses ideas and reasons grounded in everyday experience, a definition that issues from that set of ideas is desirable for practical sake.

For this thesis, "semantic inconsistency" means "a semantic relationship that lacks harmony and/or agreement." "Harmony" is how well the concepts cohere and make sense together. "Agreement" means several things but can include how the conceptual fits with the way the world works, interpersonal acknowledgement, and even truth-values.[77] "Weak semantic inconsistency" is the exclusive disjunction in "lacking harmony or agreement" whereas "strong semantic inconsistency" is the conjunction in "lacking harmony and agreement."

In the RZ article, the cartilage damage to the neck is an example of "weak semantic inconsistency." The damage does not agree with damage from hanging, however, it is harmonious with the general idea of hanging by suicide. It is plausible that the damage is still from the hanging (hanging generally affects the neck), which is why it is harmonious, but in terms of location on the body (lower neck), it does not agree with hanging but agrees with strangulation.[78] Also in the same article, the writing – "Can you save her…" – is another example of "weak semantic inconsistency." RZ's purported writing of the note is in harmony with the official suicide story; however, it lacks agreement with the facts due to height and gender specific writing style.

In the RZ article, the fact that she supposedly bound her own feet, her arms behind her back, and gagged herself, all while naked, and then jumped over a rail in a suicide attempt is an example of "strong semantic inconsistency." Bound feet and arms and jumping over a rail, for instance, are not harmonious with our general conception of suicide nor is it in agreement with what is physically likely.[79] [80]

"Weak" and "strong" semantic inconsistency articulates a subtle distinction that in some cases may not clearly apply. Nothing important hangs on this in

[77] We define "harmony" as relating to coherence; "agreement," refers to correspondence.
[78] An interesting side note. In the autopsy report on RZ, her neck was not broken, which is normally the cause of death in a hanging, especially from a nine–foot rope and jumping over a balcony in free fall (Autopsyfiles.org 2011). But without this additional information in the argument, it cannot be classified as "strong semantic inconsistency."
[79] Our "general understanding" is a background from which we make and judge beliefs. It is the material we make inferences from. Statistics show that women, for instance, rarely engage in violent suicides, but men do (Albrecht 2011). The fact here that she supposedly chose a violent means and had to accomplish quite a feat to do it undermines that it is a "conventional" suicide.
[80] In a strange turn of events, the man who found her, Adam Shacknai, is also the main suspect in the writing on the wall (10 News Digital Team 2017). He cut her down, placing her where her body laid for news helicopters to view (Davis and Baker 2011). His fingerprints on the rope can be explained away after the fact as being there due to cutting her down. According to her Asian/Burmese heritage, she would have never committed suicide naked, another strong semantic inconsistency (Albrecht 2011). Finally, "agreement" is a plausibility judgement in this case, it may be possible to do this, but not likely.

those cases if the general concept applies and is useful. Please note, there was no discussion of truth-values or the truth of either account, suicide or murder. While the evidence may lend support to a stronger belief in one or the other, there is not a definitive answer to assign truth or falsity to either account with certainty.

4.6.2 Antonyms

Dictionary.com (2016a) defines “antonym” as “a word opposite in meaning to another.” “Black” is an antonym to “white,” for example. “Opposite” refers to the difference in meaning, in this case, one excludes the other. This ordinary understanding of “antonym” is what many of us are taught early on in our language education with exposure to relational terms like “thick” and “thin” (Owens 2012: 257–258). With our early exposure to antonyms, we likely had our first exposure to inconsistency, through linguistic inconsistency. Opposition of ideas is taught relatively early in development roughly 3–5 years old, where we begin to form our “canonical” understanding of antonyms (2012:257). Canonical antonyms are the word pairs, which are, exemplars of antonyms, for example, black/white, alive/dead, new/old, etc. (Jones, Murphy, Paradis & Willners 2012:22).

To better understand the function and nature of antonyms, a more detailed version is helpful. Jones, Murphy, Paradis, and Willners (2012:134) define “antonymy” as:

> “… as binary opposition in language, a Relation-by-Contrast on the basis of minimal difference and maximal comparability in a given context. Such a relation holds among members of a pair if and only if they have the same contextually relevant properties but one.”

Beginning with “binary opposition,” antonyms are pairs of words. Each word is opposite such that it cancels out the other word in the pair in some way. For example, “tall” and “short” function in this way and are “unbound” antonyms. “Unbound” pairs typically use a qualifier of some sort, like “very”, as in “very tall” and “very short”. In contrast, “alive” and “dead” are “bound” antonyms and do not have a qualifier; one cannot be “more dead” than “dead”. While the pair "tall/short" do not cancel each other out in the same way as "dead/alive," the concepts are still in binary opposition.

A very important definition introduced by Murphy is "Relation-by-Contrast" (2003:44). This is a stipulative definition, which notes similarities and one difference. Murphy (2003:44) defines "Relation-by-Contrast," as a contrastive relationship that holds among all members of a set if they have the same contextually relevant properties but one. So, there are ways they are similar ("maximal comparability") and dissimilar ("minimal difference").

The idea of "minimal difference" is reduced to one difference per the definition, whereas "maximal comparability" are the remaining properties in the appropriate context. These concepts are a bit abstract until put into a normal context. The pair "black/white" shares that they are the only two basic colours that are unmixed and achromatic. However, they are incompatible because they cannot refer to the same colour, the one difference (Jones, Murphy, Paradis and Willners 2012:3).

With a better idea of what "antonymy" entails, a theoretical discussion follows that aids in understanding a broader conception of the theory of how antonyms work in everyday life.

4.6.2.1 Antonym theory: lexical-categorical versus conceptual

There are two general antonym theories. The traditional theory is the lexical- categorical theory (or the canonical model). According to Jones, Murphy, Paradis and Willners (2012:44–45), this theory has two distinguishing elements: "… antonym relations are represented as part of the lexical entries of the opposed words; and consequently that such relations are stable properties of words." To simplify the theory, antonyms are either direct or indirect. A direct antonym is the exemplar of a set and it stands in opposition to another direct antonym, which is an exemplar too, "wet/dry" for instance. An indirect antonym is part of that set of the direct antonym and is synonymous in meaning. For example, "moist," is part of the set and synonymous in meaning with the exemplar “wet” (2012:44). Members of the indirect set, still oppose in meaning, such as in “moist/dry” or “moist/arid.” A summary of the lexical-categorical theory centres on two points: lexical pairs of words that are in opposition, either directly or indirectly, and those words that have set, stable meanings.

The conceptual theory does not deny word pairs expressing opposition. However, “antonymy” is not a fixed, black and white, phenomenon with respect to meaning and use. The canonical antonyms still hold, but they are but one of many antonymic phenomena. Many antonyms in human experience tend to be scalar and gradable, but these explanations are contextual. Whereas the lexical-categorical approach has strong affinities with a stable lexicon of word relationships, where the conceptual theory does not. The conceptual theory uses the Lexical Meaning as Ontologies and Construal (LOC hereafter) use theory of antonymy (Jones, Murphy, Paradis & Willners 2012:127):

> “The basic assumption of the LOC framework … is grounded in how we as humans perceive and understand the world around us. Meanings of lexical items are dynamic and sensitive to contextual demands, rather than being fixed and stable, and lexical items evoke meanings, rather than “have” meanings …” (2012:129)

Consider the pair “weak/strong,” which is an unbound antonymic pairing. If this pair has a fixed meaning, it is hard to understand what a “weak/strong” alcoholic drink, a “weak/strong” person, and a “weak/strong” argument all have in common with meaning, outside of opposition. Rather, it is the context that gives or “evokes” these pairs’ meanings, which seems to undermine the notion of a stable meaning.

Furthermore, on the LOC framework, not all words have an obvious pair, but instead function contextually within a complicated meaning structure (Jones, Murphy, Paradis & Willners 2012:138). For instance, “She prefers plastic surgery to dental surgery” takes “plastic/dental” as a pair in the given context. Take the pair out of this context and it is hard to determine what single property they share; however, in the context it is clear. Antonymy is not limited to particular words, word structures or word classes, it ranges, potentially, over the whole lexicon (2012:132).

Three additional theoretical elements of LOC need more elucidation: ontology, construal, and the linguistic ontological structure. Jones, Murphy, Paradis and Willners state (2012:130):

> "Ontologies are conceptual structures that may be lexicalised and Construals are cognitive processes that operate on those ontological structures when we use language to create meaning in communication with other people."

In this sense, "Ontologies as conceptual structures" are "pre-meanings" of the words in use that set a basic linguistic context or frame, yet are completed through discourse and context, i.e. through the Construal (2012:130). For example, in the "weak/strong" pair, there is a basic understanding without context of the binary opposition. Furthermore, the pair's meaning is completed based on the discursive context, for example, a context of argument versus a context of drinking completes the meaning of the pair.

Per Jones, Murphy, Paradis and Willners (2012:135) the linguistic ontological structure is an "… ontological structure divided into two antonymic parts." It is a structure "… that comes about through comparison and dimensional alignment along a contentful dimension." This is a rather wordy way of explaining that there is a pattern of binary paired words that make sense as an opposing pair given a context. The authors (2012:134 & 136) use "Gestalt" to give a visual representation to the antonymic phenomena but also to reinforce the structural integrity of the pair (or pattern). In "Gestalt" the definitive structure not only expresses the binary opposition; it also limits the context to one relevant to the structure. This visual theory may or may not clarify the antonymic phenomena, more importantly though, it has the essential elements of contrast in a context which LOC needs.

To bring this all together, as humans, we use words for a purpose, which is to communicate. Antonym use is for special purposes to express contrast. Instead of a strict canon of opposing words, we use words in diverse ways to express this contrast. Some of these ways use obvious pairs, like “dead/alive,” and others use pairs that are only obvious in a precise context, like “plastic/dental.” The LOC supports a way to understand these phenomena through Ontology and Construal, which provides the basis for understanding the meaning of pairs and the extension of that basic meaning to the relevant context issuing in a robust contextual meaning.

Much of this stands in opposition to the standard lexical-categorical theory that supports direct pairs (and the synonyms) of opposition as part of a lexicon, with stable word meanings. The lexical-categorical theory is not contextually fluid nor does it easily allow for paired instances that are not part of the antonym canon and related words to those canonical pairings. These limitations harm its potential use as an explanatory means for what we do when we express contrast, not just in obvious constructions, but those that are not so obvious as well. Human communication can be subtle and a theory of opposition needs to be equally as subtle to give due credit to what we do in human discourse with semantic contrast.

4.6.3 Natural language arguments and semantic inconsistency

In this section, the conceptual antonym theory is applied to natural language arguments. This application demonstrates that judgements of semantic conflict are based in context and application. Within critical reasoning, the truth-values of premises and conclusions may or may not be known, so they have limited relevance to understanding or even addressing the plausibility of the argument. This plausibility assessment must come from somewhere else, and that is context, or agreement with the general understanding of the way the world works.[81] If this application is correct, it undermines the rationale for using propositional or any formal method to assess the truth-value determination or implicative rule use in an argument.

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[81] Context is situated in the general understanding. Thus, the context is a subset of it. Our general understanding of education is that students sit at desks. However, in a basketball class, there are no desks, just a gymnasium. The context shift makes sense given the difference in activities in a classroom and gym. And the shift between the two rests on our general understanding of education.

4.6.3.1 Conflicting reasons

Natural language arguments, when taking place in the context of ordinary or controversial issues may have reasons that conflict. This conflict can take on a few different forms, but the difference in forms may be only a difference in degrees. Bound antonyms are going to be strongly binary, whereas unbound antonyms will be lesser in degree. But more needs to be said about the degree and how it impacts an argument, which is where we now begin.

4.6.3.1.1 Degree of conflict and contextual judgement

Considering the RZ argument, think through the following reasons. Dying from hanging is an upper neck asphyxiation injury; dying from strangulation is a lower neck cartilage asphyxiation injury. These two reasons conflict but given the same general location of the neck, it is not implausible to think cartilage injury was the result of the hanging too. These reasons, conflict, but not strongly so. On the other hand, with respect to the analysis of "She saved him …" writing on the wall, female handwriting strongly conflicts with male handwriting in this context. "Male/female" is a canonical pair of antonyms, whereas "upper neck/lower neck" is not.

But, as the conceptual theory of antonyms supports, rarely are single ideas understood in isolation. The "male" designation links with the other person in the house, and his relationship to the deceased boy. The "lower neck" injury works with the note on the wall not being written by RZ, her being bound, and thrown over the railing to cover up a murder as payback by those related to the son's death.

The general context makes both the suicide *and* murder intelligible and plausible. The specific contexts of her death being a murder *or* her death being a suicide make each explanation intelligible and plausible as well. But to settle the specific contexts, more information in the form of reasons, is needed to sway the plausibility of one context over the other context. For instance, if RZ were left-handed or if one of the relatives of the boy confessed to RZ's murder, the plausibility of a particular conclusion would be moved in a particular direction.

4.6.3.1.2 Differences to conclusions

With the ADM, reasons must be semantically and inferentially relevant to their respective conclusions. Reasons that conflict are highly likely to be relevant to different conclusions, which are conclusions that compete as the right answer to the context question. In the RZ argument, both conclusions mentioned in the argument have some distinct reasons associated with them, and they also have some reasons in common. The reasons in common typically are not going to have or display the same relevance as those specific to the unique conclusions. Let us revisit the RZ argument:

R1: Investigators say RZ bound her own hands behind her back and legs, and gagged her mouth.
R2: Investigators say RZ wrote "She saved him, can you save her?"
R3: Investigators say RZ jumped over the rail on the balcony and hung herself.
R4: Zahau's family lawyer says what was written in R2 is at the wrong height for RZ.
R5: Zahau's family lawyer says male at the home was the right height for what was written in R2.
R6: Zahau's family lawyer says handwriting analysis indicates what was written in R2 was written by a male.
R7: Zahau's family lawyer says damage to RZ's neck was due to strangulation given the location on the neck of cartilage damage.
R8: Max Shacknai (MS) died while under RZ's supervision.
R9: The family was very distraught including MS's mother, her sister, MS's father, and his brother, the male who was at home.

CQ: What happened to Rebecca Zahau (RZ)?
CC1: RZ committed suicide.
CC2: RZ was murdered (strangled).

The main way to detail the relevance of conflicting reasons is through relevance articulations. The robust way of doing this is to do a relevance articulation for each reason, which would be:

R1 is relevant because it helps CC1 (and hurts CC2).
R2 is relevant because it helps CC1 (and hurts CC2).
R3 is relevant because it helps CC1 (and hurts CC2).
R4 is relevant because it helps CC2 (and hurts CC1).
R5 is relevant because it helps CC2 (and hurts CC1).
R6 is relevant because it helps CC2 (and hurts CC1).
R7 is relevant because it helps CC2 (and hurts CC1).
R8 is relevant because it helps CC1 and CC2.
R9 is relevant because it helps CC1 and CC2.

By formulating the relevance articulations in this manner, the relationship of reasons to particular conclusions is clear. R1–R3 and R8–R9 are relevant to CC1, and R4–R9 are relevant to CC2. The articulations show the inconsistency of reasons, manifest in different, competing conclusions. The ultimate step to establish the relevance of the conflicting premises involves ranking the conclusions. Suppose we take the strength of the additional information about her murder as more plausible, the conclusion ranking would be:

R1: Investigators say RZ bound her own hands behind her back and legs, and gagged her mouth.
R2: Investigators say RZ wrote “She saved him, can you save her?”
R3: Investigators say RZ jumped over the rail on the balcony and hung herself.
R4: Zahau’s family lawyer says what was written in R2 is at the wrong height for RZ.
R5: Zahau’s family lawyer says male at the home was the right height for what was written in R2.
R6: Zahau’s family lawyer says handwriting analysis indicates what was written in R2 was written by a male.

R7: Zahau’s family lawyer says damage to RZ’s neck was due to strangulation given the location on the neck of cartilage damage.
R8: Max Shacknai (MS) died while under RZ’s supervision.
R9: The family was very distraught including MS’s mother, her sister, MS’s father, and his brother, the male who was at home.

CQ: What happened to Rebecca Zahau (RZ)?
1. CC2: RZ was murdered (strangled).
2. CC1: RZ committed suicide.

The top ranked conclusion, CC2 is justified by the strength and number of reasons, and the degree to which the conflict between the reasons swayed the plausibility of the alternative story, that is, murder.

In a natural language argument, the ADM uses inconsistency, especially antonymic conflict, to highlight the contentious reasons. These reasons are not evaluated in isolation, instead their relevance is assessed in their relationships to the conclusions. This structure is a natural model of inquiry where information rarely meets the ideal of consistency but it provides a way to make sense of the inconsistency, all without reference to truth-values and formal logical implication.

4.6.3.2 Conflicting conclusions

Natural language arguments, when taking place in the context of ordinary or controversial issues will have conclusions that conflict. This conflict can be articulated as the conclusions need to be mutually exclusive, however, this relies on truth-values, and those values have not yet been determined. Conclusions need to express a strong semantic inconsistency with one another, similar to canonical antonymy in an ideal case.

4.6.3.2.1 Degree of conflict and contextual judgement

Conclusions should be strongly inconsistent with each other in the most arguments. They should lack harmony with each other and disagree with the interpretation of some of the facts and reasons in the argument. If the conclusions are inferences from a unique set of reasons, that particular set should inferentially support or justify one conclusion over another.

In the RZ argument, the conclusions, “She committed suicide” and “She was murdered” display the antonymic property necessary for contrast. In a linguistically same sentence type, “Rebecca Zahua’s death was the result of murder” and “Rebecca Zahua’s death was the result of suicide.” “Murder” and “suicide” both involve the death of a person; however, the means differs; other-inflicted versus self-inflicted. The consequences of this antonymic pair are different too: with “murder” someone needs to be punished according to law; with “suicide” no one needs to be punished.[82] While the consequence aspect has not been examined, it follows from the antonymic pairing in this case, and provides another basis for conflict. Thus, the implications to the broader context are directly relevant to the conclusions and their contrast.

4.6.3.2.2 Differences to reasons

The general concept of argument is unidirectional, where inference goes from premises to conclusions. Most arguments work in this manner and do so effectively. But, in complex inquiry, what someone is seeking is an explanation of what happened, and how the information all fits together. Simple inquiry normally does not require the same degree of explanation because of its normally practical context.

Inference to the Best Explanation (IBE) might be our most basic form of argument.[83] IBE arguments are about explanation, conclusions in particular, which explain some of the reasons that are facts of the event. Peirce introduced the concept of IBE as “abduction,” distinguishing it from both deduction and induction. Peirce’s abductive argument schema is as follows (1903:188–189):

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[82] The notion of “punishment” is a strong contrast that may show “self-murder” is not a good interpretation of suicide.
[83] Wright (2001:199) makes this claim, given the nature of justification and explanation in many arguments. Explanation serves a strong purpose in our understanding of how the world works in a way that justification does not.

> "The surprising fact, C, is observed; But if A were true, C would be a matter of course, Hence, there is reason to suspect that A is true."

With ideas and a context from a typical criminal investigation:

> We observe blood on the floor, a kicked in door, a bullet casing, and a lifeless body. We call these observed facts, **C** in Peirce's schema.
> Hypothesis: the person was murdered. We call this supposition **A** in Peirce's schema.
> If it is the case that the person was murdered, all of C follows.
> Therefore, there is good reason to suspect that the person was murdered is true.

Unfortunately, the structure of Peirce's schema does not clearly reveal the two-directional nature of the argument. However, the ADM can handle the two-directional nature of the abductive or IBE argument. But let us briefly review the ADM and then add to it.

The complete model of ADM has a Context Question, Reasons and Competing Conclusions:

R1–R?

____

CQ

CC1

CC2…

The structured form with content and something familiar to most people:

R1: The ground is shaking.

R2: We are in California.

____

CQ: What is going on?

CC1: There is an earthquake.

CC2: There is a natural gas explosion.

In the previous section where reasons were relevant to conclusions, the ADM has reasons that justify the conclusions. So, the direction is from the reasons to the conclusions. In an IBE argument, there is an additional direction where the conclusions explain *some* of the reasons. The reasons that are explained are "event facts." An event fact is a part of the event, or evidence, which is explained by a conclusion. So, consider the argument now in two-directions:

Explains Reasons

R1: The ground is shaking.
R2: We are in California.
R3: There is a big ground crack.

Justifies Conclusions

CQ: What is going on?
CC1: There is an earthquake.
CC2: There is a natural gas explosion.[84]

The event fact(s), reasons, are determined by analysing whether a conclusion explains the fact. "There is an earthquake," explains why "the ground is shaking," and "there is a natural gas explosion," explains why "the ground is shaking," as well. So, all conclusions explain R1. When all conclusions explain an event fact, we call it a "necessary event fact (NEF)." When one but not all the conclusions explain an event fact, we call it a "contingent event fact (CEF)."[85] CC1 explains R3, but CC2 does not, so R3 is a CEF.

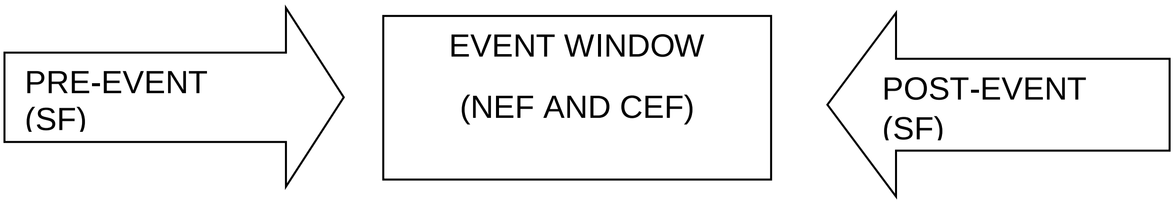
Notice, however, that R2 is not explained by any conclusion, that there is an earthquake or natural gas explosion does not explain why we are in California. When a reason is not explained by a conclusion it is labelled as a "subsidiary fact (SF)." Subsidiary facts add information to the argument and aid our explanation of

[84] As far as is determinable, Wright (2001:206–213) is the only one to articulate the two-directional nature of IBE arguments in this manner.

[85] This formulation is similar to Wright's work on trace-data and non-trace data (2001:206–213). I prefer the idea of "facts" to "data" for ease of student understanding because students often associate "data" with information technology, and thus oftentimes do not understand the general meaning of "data", which contains the idea of "facts". Hence, the usage of the term "facts" may just make for easier explication. The material on ADM-IBE comes from Dixon (2017:86–89).

event facts, such that R2 works with CC1 in explaining R1, and in contrast, R2 does not work with CC2 in explaining R1.

Another way to determine event facts is to look at the event window, which this is particularly relevant to this argument. Evidence and event facts occur in the event window; SF's largely occur outside of the event window and act as explanatory means for understanding the event facts.



Using the ADM-IBE, with the RZ argument and two-directions in mind:

R1: Investigators say RZ bound her own hands behind her back and legs, and gagged her mouth.
R2: Investigators say RZ wrote "She saved him, can you save her?"
R3: Investigators say RZ jumped over the rail on the balcony and hung herself.
R4: Zahau's family lawyer says what was written in R2 is at the wrong height for RZ.
R5: Zahau's family lawyer says male at the home was the right height for what was written in R2.
R6: Zahau's family lawyer says handwriting analysis indicates what was written in R2 was written by a male.
R7: Zahau's family lawyer says damage to RZ's neck was due to strangulation given the location on the neck of cartilage damage.
R8: Max Shacknai (MS) died while under RZ's supervision.
R9: The family was very distraught including MS's mother, her sister, MS's father, and his brother, the male who was at home.

CQ: What happened to Rebecca Zahau (RZ)?

CC1: RZ committed suicide.
CC2: RZ was murdered (strangled).

To see the relationship from the conclusions back to the reasons in the explanation direction, IBE articulations follow:

CC1 explains R1, R2 and R3. (CEF)
CC2 explains R4, R5, R6, and R7 (CEF)
R8 and R9 work with CC1 and CC2 in explaining R1–R7. (SF)

R1–R7 are in the event window and require explanation, for they are event facts. R8 and R9 are outside the event window and provide explanatory resources. "Explanatory resources" might also be thought of as the information that pieces together the facts of the event into a coherent story. The explanatory articulations divide into those of CC1 and CC2 and their related reasons. The division in the conclusions, leads to a division of reasons and these divisions manifest conflict.

4.6.3.3 Rationality and inconsistency

"Rationality" is a buzzword of sorts, not only in philosophy but in everyday life. It is a concept that most people think they understand. But it seems to share the same fate as was ascribed to "critical thinking", namely that multiple definitions abound. For our purposes, the working definition will be from Cherniak's work (1981:164–174) on minimal rationality. Cherniak's work is chosen because he incorporates two other principles – namely, minimal consistency and basic inference ability – into a complete theory of rationality, wherein the three elements function together holistically. Cherniak has three principles, the first of which is the basic rationality principle: i.e. if a person has a particular group of beliefs and desires, the person would undertake some, but not necessarily all, of those actions that are appropriate in the context (1981:166).[86]

[86] The other two principles are presented in the next chapter in a discussion of non-monotonicity.

The basic rationality principle ensures that a person operates from a belief set (Cherniak 1981:166). To understand someone's belief set, is to determine what actions that person might perform in that context. Considering a shared worldview, we understand that most of us make sense of each other's actions and what we might do in specific contexts. However, imagine someone who acts outside one's belief set, or does not perform any of the actions that are fitting in the context: the person's rationality might be challenged. Taking into account this basic structure of shared worldview, reasons can be added to arguments resulting in new conclusions as part of ordinary reasoning practices.

For example, imagine being in a classroom and the fire alarm sounds. Being on campus for extended lengths of time, one realises that sometimes these are false alarms and at other times they are drills. A suitable action might be to check the hallway for smoke, or call the department office for more information, or check the alert system on the computer. Given the belief set of an instructor on that campus, these would be proper or rational actions. In short, one would be acting rationally. But what if one told the students: "Run, we are all going to die!" or "Everyone drop to your knees and pray we do not all burn to death!"? The students might initially think that the instructor was joking, but if one were serious, they would think one was being irrational given the nature and frequency of known false alarms on the campus. Neither of those exclamations properly follow from the instructor's belief set, so one would be acting irrationally.

The basic rationality requirement also takes seriously dissimilar cultures and groups of people. "Rationality" is defined by a certain group of beliefs, and is commonly known, for diverse cultures have different beliefs. This is a very important point. The basic rationality requirement permits distinct, intercultural understanding of beliefs and the resultant actions, and make adjustments that hopefully facilitate better understanding.

In the following subsections, there is a discussion of the relationship between rationality and two types of inconsistency: substantive and non-substantive. This discussion clarifies when rationality is in jeopardy and the apt response to it.

4.6.3.4 Substantive inconsistency: inconsistency negatively influences the rationality of the argument

The context of a natural language argument is rich and meaningful because it aids in understanding the scope and nature of reasons and conclusions. Previously, “strongly inconsistent” was defined as “a semantic relationship that lacks harmony and agreement.” Basic rationality works from a belief set to undertaking some relevant action which is appropriate in the context. When a belief set is strongly inconsistent, the appropriate action in the context may or may not have the right kind of traction to instantiate. This is a fact of strongly inconsistent belief sets: they can paralyse any potential action.

Since arguments interact with belief sets, it may be the case that a person has a belief set that is reasonably consistent. Yet, this person asserts in an argument a claim that is strongly inconsistent with their belief set. Resolving this inconsistency matters, because predictable action is desirable and makes the action intelligible to others and oneself.

But we have digressed. Let us refocus on the discussion of rationality and arguments. What if a text or passage has an argument that is strongly inconsistent? What should be done then? The simple but not always obvious answer is that the general context needs to be consulted about the inconsistency. Does the general context support one side of the inconsistency more than another? From a broader perspective, is there more evidence or reason to believe one side of the inconsistency than the other? In the RZ case, the height of the handwriting and likely being a male is strongly inconsistent with RZ’s height and gender. There is no obvious resolution of these two conflicts, so being rational will involve looking at other reasons, like binding her own feet and arms and jumping a railing with other reasons. This holistic method situates a context so the inconsistencies make more sense as part of an overall account. What if we did some research and found out that a noted forensic pathologist determined through a second autopsy that RZ had a mark on her scalp that indicated she had been hit on the head prior to her death?[87] The strong conflict is now weaker with additional evidence and believing that RZ was murdered becomes more plausible. Plausibility and rationality go hand in hand. So, when semantic inconsistencies affect the rationality of an argument, one way is to look at the broader context for believing one side of the conflict over the other one. More evidence will likely help this along too, and eventually lead to action, which in this case might well be murder charges against a suspect.

But what of those cases where strong semantic inconsistency cannot be resolved or at least moved in the direction of improving plausibility? What is the rational thing to do? The unsatisfying answer is recognising the limit and scope of natural language arguments. It is too much of a demand to place on the concept of natural language argument to resolve these instances of flawed arguments.[88] "Flawed" just means "the normal function of argument is impotent." Thus, the argument content is the problem, not the argument form or use of it. It is "impotent" because of special reasons that are not fertile for rational action.

More can be stipulated considering this type of flawed argument and rationality. For instance, several relationships are possible:

i. a person's belief set may be inconsistent;
ii. an argument may be inconsistent in the reasons;
iii. a person's inconsistent belief set may be consistent with an inconsistent argument;
iv. a person's inconsistent belief set may be inconsistent with an inconsistent argument;
v. a person's consistent belief set may be inconsistent with part of the general context;
vi. an argument may be inconsistent in the reasons and inconsistent with the general context.

[87] This is exactly what happened when the Dr. Phil television show hired Dr. Cyril Wecht, a noted forensic pathologist, to do a second autopsy on Zahau's body (Dr. Phil Show 2011).
[88] Not all arguments can be resolved and it may be a function of this type of argument that some are beyond hope and saving.

Each of these (i–vi) has its own problems and shows how quickly inconsistency can get viciously complicated. To detail each of these would be of limited value to this research, but if inconsistencies are problematic they reflect our complicated lives and belief patterns. More so, accurately diagnosing the impact and relevance of multiple inconsistencies is a subtle skill but it all starts with deciding whether an inconsistency is substantive or not. Still, the importance of each is that each can affect rationality in their own way and may result in a lack of action. This is the true danger of inconsistency's influence on rationality that may leave one paralysed and unable to act.

4.6.3.5 Non-substantive inconsistency: inconsistency does not negatively influence the rationality of the argument

Previously, "weakly inconsistent" was defined as "a semantic relationship that lacks harmony or agreement." Furthermore, basic rationality works from a belief set to undertaking some relevant action that is appropriate in the context. When a belief set is weakly inconsistent, the appropriate action in the context will likely have the traction to instantiate action. This is a fact of weakly inconsistent belief sets; they are unlikely to disrupt any potential action. As "weakly inconsistent" is a stronger concept than "non-substantive inconsistency," the impact of the inconsistency is unlikely to be disruptive to the whole argument.

One way to understand a non-substantive inconsistency is as a "surface" phenomenon. The inconsistency itself may be tangential to the point being proven or its resolution does not influence the inference structure, such that another conclusion becomes much stronger. In the RZ argument, the conflict between the locations on the neck is a sign for more investigation; however, a definitive answer outside a confession from someone strangling RZ is doubtful. One might question why, so let us think through this scenario. Imagine that RZ did commit suicide. However, instead of just simply jumping over the balcony, she jumped very hard away from the balcony with her chin down holding the rope at a much lower location on her neck. The arc of the fall with the rope attached to the neck might have been closer to the base of her neck causing the cartilage damage, and then she died from asphyxiation.[89] The arc might also explain why her neck was not broken due to a lack of abrupt motion change.

Rationally, the reasons support neck damage, which is what we act on, if we choose to. The damage to the neck is explainable on both accounts, which makes believing in one side of the conflict problematic. The significance of the location on the neck may never be resolved. But what might aid is further related information that fills in a greater picture. For example, the supposed suicide note, the only male in the house having motive – as his nephew is the one who ultimately died – and the physical problems with a bound person of short stature going over a balcony railing. The theoretical point is that reasons do not exist in isolation, an argument works as a whole structure, which is another holistic judgement of rationality not just related to the rationality of a conflicting belief set.

4.7 Concluding thoughts

The associated research question for this section was, *how can a contemporary antonym theory articulate inconsistency judgements in natural language and reasoning?* Throughout this chapter, many concepts and their delineations were put forth to show how semantic inconsistency functions in natural language arguments. Using the ADM and the ADM-IBE, inconsistency was shown to be part of our ordinary argument structure when questions and answers are part of an inquiry. The ADM/ADM-IBE argument structure consisting of questions, answers/conclusions, and reasons differs from traditional arguments where there are just reasons and a single conclusion. The significance and use of the traditional argument model is likely a carryover from Aristotle's syllogism (1984), where premises support a single conclusion, without a broader context. Rarely, are conflicting reasons apparent in a traditional argument. The traditional argument model, when used with inconsistencies, attempts to resolve or prefer one of the inconsistent reasons of the inconsistent pair *before* the argument is

[89] The County of San Diego autopsy report (Autopsyfiles.org 2011) on Zahau does not indicate her neck was broken, which may have been the causal result of a direct, non-swinging, nine-foot fall. A 105lb. body generates a lot of force over nine feet, which is another curious part of this story.

schematised. This resolution of the inconsistency pre-schematisation is an *ad hoc* move, which does not allow the general context to settle through related content – through argument – which reason should be given up (if at all).

Using an antonymic understanding of conflict and an ever-changing world, especially in the scope of inquiry, the ADM/ADM-IBE uses semantic inconsistency as a part of its structure. While there is no necessity in reasons conflicting, the conclusions will, which gives due regard to our practical understanding that there are competing answers to a question. While this section is not a defence of the ADM/ADM–IBE, it must be understood as an integral part of a semantic conception of inconsistency that can be embraced to provide plausible arguments.

A semantic conception of inconsistency works by noting a lack of harmony and/or agreement. While appeals to psychology and studies may be marshalled for this conception, another direction will be pursued. David Hume (1983:15–16) wrote about the sentiments of approbation and disapprobation, or approval and disapproval. Hume, in *The Enquiry Concerning the Principles of Morals* (1983:44), stated that in the biggest or smallest judgements, these sentiments were operative and take place rather quickly. In short, a person gets a feeling one way or another about something. While it may be by experience, part of our education, innate, or by some other means, these feelings guide our judgement. Hume, however, warned us that reason should be brought in to justify or reject these feelings, or as he said to "examine" them (1983:15).

If Hume is right and the extrapolation to argument is correct, one approaches an argument, and gets a feeling about it. While this may be read as a simple emotional reaction (and surely that is part of it), it is more likely a complex relationship founded on one's knowledge, experience, inference abilities, and the argument context. If the context has semantic conflict, but the argument does not, as in the traditional argument form, a feeling of disapproval results as the argument does not properly articulate the situation. However, if the argument and context align, and the semantic conflict is properly articulated, at least the initial sentiment about the argument is approval. The semantic conflict itself does not bring about an initial sentiment of disapproval. The normal reaction to semantic conflict, I suspect, only gets warped when one has a formal logical education where contradictions and inconsistency are bad. The evidence for this claim rests on inconsistency in everyday life being a notion of conflict, without a necessary negative value. Where then does the negative value come from? Seemingly from outside of the conflict and through a perception of formal logic and how it dictates thought. Semantic conflict, when warped, then takes a different significance and arguments are schematised to purposely avoid this conflict.

A theory of semantic inconsistency does justice to our ordinary perceptions of conflict. This conflict is often antonymic and relies on our basic linguistic competencies. Any logical inconsistency comes secondary to the semantic judgement. Indeed, as truth-values are not always known, a logical judgement founded on them is impotent. But truth matters, and is a focus of reasoning, so it is not completely done away with in this proposed model. Understanding, especially with natural language arguments, matters more as it does little good to know if something is true or false, but not to understand the argument. Understanding always precedes evaluation. By focusing on semantic inconsistency in an argument, one can ascertain whether the conflict affects the rationality of the argument, and if it does not, the value of the inconsistency is minimised. However, if the conflict does affect the rationality of the argument, one can look for contextual support to enable further understanding and potentially follow a direction in choosing one side of the conflict. In the rare cases where rationality is undermined through paralysis, the semantic conflict signals that it is time to start over. But this is the alternative at the end of the process, not the beginning where inconsistency may have the same paralysis for those not fully engaged in necessary analysis of semantic conflict.

In this chapter, a theory of semantic inconsistency was put forth as representative of inconsistency judgements in everyday life. These judgements are based on semantic conflict, which is taken as prior to truth-values or logical form. These latter two concepts, as demonstrated in chapter two come from formal logic, most likely propositional logic given its incorporation into critical reasoning courses.[90] This incorporation of a formal logical system is questioned and criticised from a pedagogical perspective in the next chapter.

[90] See Dohman (2017), Heis (2016), May (2010), Michelfelder (2011), Monge (2015), Morton (2009), Price (2011), Poston (2012), Sun (2011), and Wallis (2017).

Chapter 5: Critiquing the pedagogy of propositional logic as critical reasoning

5.1. Introduction

There is a pedagogical issue of whether the content of critical reasoning courses should overlap or even contain the same material as introduction to logic courses. One may argue that critical reasoning courses and introduction to logic courses should not be the same, or even a somewhat similar course. However, after a survey of textbooks on the market, it is hard to distinguish them in many cases – supposing the textbook and course align in name.[91] Salmon (2012) confirms this attitude with its title *Introduction to Logic and Critical Thinking* as a combination of both. The common difference is that critical reasoning texts include more about natural language but doing this with the taught logical system in mind – Aristotelian and/or propositional – and usually translation between natural language and the formal logical language.

This chapter embraces a cautionary stance about the distinction between critical reasoning and introduction to logic courses. The distinction begins by considering the role of propositional logic in critical reasoning courses. Propositional logic is central to introduction to logic courses and no argument is being made to the contrary. When done properly, a progression from syllogistic logic to propositional logic displays a logical continuum and informs students on different systems of logic. This greater understanding is an integral part of introduction to logic courses, as the naïve conception is that there is only one logical system, whatever that may be.

[91] Among those surveyed are: Bennett (2004), Cavendar and Kahane (2010), Cederblom and Paulsen (2005), Epstein and Rooney (2012), Gensler (2010), Groarke and Tindale (2012), Hurley (2014), Moore and Parker (2015), and Salmon (2012).

5.2 Critical reasoning v. introduction to logic

The inspiration for this section comes from the informal reasoning movement.[92] The informal reasoning movement began in North America in the 1970's (Groarke 2011:§1). This movement sought to distinguish formal reasoning from informal reasoning, and in doing so brought new thoughts on reasoning to the table. Critical reasoning courses are informal reasoning ideas in practical life. Groarke (2011:§10) writes that informal reasoning's domain is at least the following:

1. "an explanation of the rules of communication which argumentative exchange depends on;
2. a distinction between different kinds of dialogue in which argument may occur, and the ways in which they control appropriate and inappropriate moves in argument (e.g. the difference between scientific discussion and the negotiation that characterises collective bargaining);
3. an account of logical consequence, which explains when it can be said (and what it means to say) that one sentence is a logical consequence of another;
4. general criteria for good argument, which may be associated with a theory of logical consequence, and which specify general criteria for deductive, inductive, and conductive arguments;
5. definitions of positive argument schema which define good patterns of reasoning (reasonable appeals to authority, reasonable attacks against the person; etc.);
6. some theoretical account of fallacies and the role they can (and cannot) play in understanding and assessing informal arguments;
7. an account of the role that audience (*pathos*) and *ethos* and other rhetorical notions should play in analysing and assessing argument;
8. an explanation of the dialectical obligations that attach to arguments in particular kinds of contexts."

Numbers 1 and 2 are communicative measures that set the context of argument in everyday life (2011:§10). We might ask, however if the curriculum design of introduction to logic courses allows enough emphasis on the communicative components such as communication rules, arguments in context, and informal argumentative moves? For example, imagine doing a predicate logic proof in the presence of the logically uninformed. What can you expect them to understand about it and its significance? Would this be the best argument to capture an argumentative context to the person without logical training? Probably not, as it is a misguided argument choice given its formal and technical nature in an ordinary

[92] Of particular influence, Scriven's (1976) seminal work on reasoning and one of his progenitors, Wright's (1999) and (2001). Fogelin's (1985) and (2003) are of substantial influence, too.

argumentative context. The same is said for someone who does not appeal to evidence in a scientific argument, instead appealing to emotion and questionable personal experience and expecting there is agreement on their reasons. Critical reasoning courses instruct on the relevance of context to argument and what counts as acceptable moves in that context.

Number 3 in introduction to logic courses normally consists of the contrast between deductive validity and inductive strength (2011:§10). However, in critical reasoning, the important contrast is more likely the differences between monotonic and non-monotonic consequence relations (this is developed later in this chapter in detail), as the latter is more relevant to everyday reasoning practices, especially in a question and answer context where questions add or subtract reasons in support of a conclusion. This relation to everyday reasoning practice is important to the curriculum because students must have a connection to what we do when we reason in everyday circumstances, and that that form of reasoning is illuminating. So, there is a difference in what should be taught in each, and spending an undue amount of time teaching deductive validity misses the mark to ordinary reasoning and its application.

Number 4 is immediately relevant to the course distinction (2011:§10). If all three types of arguments are important to informal reasoning, it seems that equal time should be spent on teaching all three and more importantly, the context of each justified. If argument is to be a tool for use, different tools perform different functions, and simply giving any argument type a priority over others *a priori* is misguided. From chapter two on propositional logic, the general criteria for a deductive argument is taught with validity and soundness, but the technical logical machinery of formal logic is not necessary. The same is said for general criteria of inductive arguments with strength, weak and strong, but the subtleties of mathematical statistical induction are not necessary. Both kinds of arguments have their place in a critical reasoning curriculum, but as contrasts to demonstrate distinct types of reasoning to students, and more importantly to aid them in coming to know how different it is from successful daily reasoning practices in natural language.

Conductive arguments have non-decisive premises but can be taken cumulatively (or not), to lead to a conclusion(s) (Govier 2009:353–373).[93] In everyday reasoning, most arguments are conductive arguments, they are not deductively valid or inductively strong. Conductive arguments also may make a distinction between epistemic and non-epistemic reasons, where the former have a truth-value and the latter do not (Adler 2013:6). Truth-values of reasons may not be known, so an argument type that works with non-epistemic reasons may be of noteworthy value to particular contexts. Conductive arguments have little said about them, in general, as they are not "paradigmatic" cases of argument, which are the subject of introduction to logic courses. So, by including them in a critical reasoning course, students have a nuanced view of argument types and their applications which are not found in introduction to logic courses.

Number 5 illustrates content that should be in every critical reasoning course (2011:§10). This material delineates when a fallacy is not a fallacy, and the contextual subtlety of natural language arguments. Contextual use of argument with argument schemas give students the basis for applying the argument in everyday life. Students should not simply be given a logical tool and be expected to figure out how to use it. However, teaching contextual use and subtlety takes time and as a curricula issue, time management is imperative. Arguably this amount of time on context and use has a small place in an introduction to logic course, where logical formal systems and their generality should be the pedagogical emphasis as opposed to the development of contextual sensitivity. But the opposite holds for critical reasoning courses, where contextual sensitivity and its relation to argument take priority over formal systems and their concerns. Thus, critical reasoning courses have a unique role in fallacy comprehension and application, when considered contextually and not simply as a label of an apparent sentence type *simpliciter*.[94]

[93] Conductive arguments typically include counter considerations, which demonstrate a limitation on the connection strength between reasons and conclusions (Wellman 1971:52).
[94] The point being made here is not an obvious one. It is my contention that students recognise precise elements about fallacy examples and look for those similarities in other sentences. For some, it may be the logical form, e.g. appeal to ignorance may have wording like "No one believes…" or the semantic content e.g. hyperbolic claims, such as, "She is a brain-dead blonde….". That is part of the assessment, but without the context, the form and content alone are not enough to determine the fallacious nature of the position being put forth.

Number 6, unfortunately takes place in both introduction to logic courses and critical reasoning courses, but without any theoretical basis for fallacies (2011:§10). Fallacies may be taught in both courses in a universalistic sense that overrides contextual grounding, so the relevant situation linking details to settling whether the fallacy applies are left out. Introduction to logic courses that do not spend an adequate amount of time on natural language use, can result in the teaching of formal logic, which students are subsequently supposed to somehow attach to informal fallacies. The result is that the introduction to logic class is disjointed in content and conceptually misguided. The contrast to the universalistic theory of fallacies is the contextual one, where context fixes the value of the fallacy. Students in both formal and informal logic courses work through contrived fallacy exercises, however, the critical reasoning students at least have something to connect the theory to, namely with ordinary reasoning practices and context. If arguments in critical reasoning courses are taught contextually, then the proper ground for fallacies is in place for a robust understanding of fallacies in context.

Number 7 is normally a function of argument and rhetoric courses in communications, psychology, and speech (2011:§10). Yet adequate attention should be given to the way emotion and psychology influences argument and how credibility matters to argument. Traditionally, this material is not covered in introduction to logic courses, but critical reasoning courses must make use of these concepts as they are relevant to argument context, especially a dialogical form of argument. Critical reasoning is not limited to formal relations and their evaluations. Instead the whole person and context are integrated in terms of understanding, feeling, and existing. Curricula demands a holistic approach showing how psychology and reasoning impact each other and how to make the most of each.

Number 8 is exclusively the domain of critical reasoning courses where “premise ∴ conclusion”-type arguments do not exemplify arguments in ordinary discourse (2011:§10). There should be some understanding of how to incorporate typical argument forms into dialogue and not violate the rules of the dialogue. One for instance, a *reductio*, incorporates easily into a context where someone has an idea of proof and contradiction. But to verbally put forth a *reductio* in the wrong audience, violates discourse norms, it is a potential context mismatch, and may be offensive, as it is not understood as it should or was meant to be. Historically, the obvious case of this dialectical consideration is Socrates, for instance in the *Euthyphro in* Plato's Collected Works*,* (1961:169–185), and his use of the *elenchus* (Vlastos 1982:711–712). Reading Plato for argument strategy is but one means to practically see the importance of taking the norms of dialogue and argument seriously. It is a curricula stretch to envision how incorporating dialogical arguments into an introduction to logic course would be done effectively. Once again, concepts require connection to experience and students need practical examples. Students need to perform it to appreciate the benefits for refining personal reasoning skills. Thus, a critical reasoning course is the pedagogical and practical choice.

Before moving forward, I want to minimise any confusion about the previous point(s) made, so I will bring them together. First, pedagogically, the content, both textbook and lecture, between some critical reasoning courses and introduction to logic courses overlap.[95] This overlap may include both syllogistic and propositional logic. In terms of syllogistic logic, two sets of concepts include the square of opposition and the basic syllogistic formulation of a major and minor premise. Venn diagrams, as an extension of syllogistic logic, are also taught in both courses. In terms of propositional logic, truth tables are taught and some rules of implication like *modus ponens* and *modus tollens,* too. If the goal of a critical reasoning course is to use principles of informal reasoning, the overlap should be minimal as the formalisation undermines the natural semantic meanings and connections.

Second, as demonstrated in the Introduction, the use of introduction to logic textbooks is not uncommon in critical reasoning courses (Poston 2012, Farmer 2017, Berger 2017 and Dieveney 2017).[96] Without supplemental material

[95] See May (2010), Michelfelder (2011) and Poston (2012).
[96] See footnotes 9 and 10 for the specifics of the last three.

emphasising natural language reasoning, critical reasoning and introduction to logic courses become the same thing as far as content.[97]

Third, we might question how sources are chosen and why. Unlike other philosophy courses that are conceptually based, competency based courses – like introduction to logic and critical reasoning – contain problems that must be solved. It is not uncommon for these sources to have solution manuals unlike other philosophy sources. Because of this problem-solving aspect, instructors may not be inclined to seek out new sources as that requires additional preparation effort and time. One explanation for this is that graduate students, who have worked through the problems with their professors, may be less inclined to adopt sources different from their professors when becoming the sole instructor of a course. If a graduate student, while functioning as a teaching assistant, uses an introduction to logic text for a critical reasoning course, the student may be less likely to change that text for the previously mentioned reasons about preparation. Another aspect of this may be that a graduate student, who becomes the sole instructor of a critical reasoning course, may not have a sufficiently rounded education to appreciate the differences between an introduction to logic course and a critical reasoning course. Thus, adopting the worked through sources becomes rote and part of the profession for some instructors.

Finally, passing down the paradigm of syllogistic and propositional logic being the ideal forms of reasoning, is pernicious to developing students' skill with natural language arguments. Some instructors of critical reasoning and introduction to logic courses do so because it is part of their teaching load, not because they are specialists in it. This lack of specialisation is likely masked by the assumption that professors, in general, are experts in critical reasoning by virtue of their advanced education and experience. When critical reasoning is understood as a field of specialisation its epistemic credibility takes on a new

[97] A search of California State University Fullerton's bookstore for Fall 2017, PHL 106 Introduction to Logic has instructor Farmer (2017) using Hurley's *Concise Introduction to Logic*, which is the same text being used for PHIL 105 Critical Thinking by another instructor McFee (2017) (http://www.titanbookstore.com/CourseMaterials.aspx). At California State University Long Beach's bookstore for Fall 2017, PHL 170 Critical Reasoning has instructors Berger (2017) and Dieveney (2017) using the same Hurley Concise *Introduction to Logic* text.

significance, which may decrease a conflation of the two courses. Arguably, when critical reasoning courses are taught with the focus on natural language arguments, they have a greater potential impact on one’s future educational success than many other undergraduate courses because they are competency, not knowledge, based. Critical reasoning courses impart a set of skills that will not only carry over to academia but across to everyday life, too. Introduction to logic courses also impart a set of skills, but it is not obvious that they are better for overall student success and carry over to other courses and life, especially when symbolisation and translation are the focus of the course.

So much then for the difference between the two courses and textbooks. The common problematic element is propositional logic and its use as a fundamental part of critical reasoning courses. The material that follows critiques this approach as flawed and varies in applicability to students seeking to learn something about ordinary reasoning and improving one’s life with it.

5.3 Translation problems undermine system application credibility

As the previous section noted, translation from natural language into formal language is a part of the problem with logic texts. More so, in chapter three, examples of translation complications were detailed, which would also stem from logic texts and problems generated for student use. But to the extent to which these complications influence system credibility in application have not been addressed. So, a similar critique will follow, but first, the theoretical issue with natural language translation, even within itself, addresses a general problem with translation. From there, questions arise about the project of natural language translation into propositional logic, with few solutions, especially as far as pedagogy goes.

Teaching at Rio Hondo College in Southern California, U.S.A., a two-year community college, is a diverse cultural experience. Over eighty percent of the students are Hispanic.[98] While there is no formal statistics regarding their fluency in various languages, many students are bilingual, to varying degrees, in Spanish and English. When these students take introduction to logic, their prior exposure to translation between natural language and logical formal language is minimal.[99] However, any bilingual student is at an advantage being bilingual because their ordinary understanding is that languages, which they are familiar with, do not always clearly translate or are isomorphic.[100]

Translation for bilinguals, like monolinguals, becomes rule following, as the semantic content of the sentences is secondary to logical form. However, knowing two languages requires knowing two sets of rules, so following different linguistic rules is part of their human experience unlike the monolingual. When Spanish/English bilinguals have difficulty understanding how the material conditional and the indicative conditional in English are different, the use of translation examples between Spanish and English, is helpful. Or, understanding the mood difference may be easier in Spanish than English if one is a native Spanish speaker. Bilinguals understand, to that end, indeterminacy of translation, which paraphrased means “I don’t know the translation of that from language ‘x’ to language ‘y’, so I will do ‘z’”, is a practical everyday phenomenon.[101]

The bilingual students may be at an early advantage in an introduction to logic course because of their everyday experience with translation. Grosjean (1989:6) notes:

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[98] For statistical verification of the student population, refer to: http://www.riohondo.edu/marketing/wp-content/uploads/sites/23/2017/05/3RioFactsSheet22May2017.pdf.

[99] Approximately, 100 students take PHIL 112 Introduction to Logic every year. An initial assessment exercise on translation is given through an in-class assignment and then again on each exam. Outside of students versed in mathematics, translation into symbols is a foreign concept.

[100] One justification for this might be Grosjean (1989:6) where bilinguals are not represented as two monolinguals, but instead as integrated lingual, “The coexistence and constant interaction of the two languages in the bilingual has produced a different but complete linguistic entity.” The implication is that an integrated lingual will have a holistic understanding, which might make integrating logical translation easier due to familiarity with translation. It also implies that the “two monolingual” picture may set up a barrier due to the lack of holistic connection in use and meaning.

[101] Grosjean (1989:6) writes, “He or she has developed competencies (in the two languages and possibly in a third system that is a combination of the first two) to the extent required by his or her needs and those of the environment.” The parenthetical is of special interest because the third system seems to be what the logicians, through translation, desire.

> "Because the bilingual is a human communicator, he or she has developed a communicative competence that is sufficient for everyday life. This competence will make use of one language, of the other language, or of the two together (in the form of mixed speech) depending on the situation, the topic, the interlocutor, etc."

However, monolingual students, especially highly competent language users, may suffer the most as the primacy of their natural language and contextual sensitivity leads them astray in the symbolic translation process. This is especially so when connective meaning in the natural language is different from connective meaning in the logical formal language. The material conditional may provide the most frustration in translation because monolingual students have difficulty understanding the logical connection in the sense of their natural language abilities.[102]

This broader context of language use is rarely thought about for systematic understanding of propositional logic. Consider a student who is trilingual versus a student who is monolingual. The trilingual student will have more exposure to translations, differences in linguistic meanings, and varieties of uses in different contexts. Having a greater general understanding of language, the trilingual student might be better prepared. Thus, diverse students coming into a logic course are not on the same linguistic and conceptual level, especially those who are bilingual and trilingual versus monolingual. Monolingual students may have conceptual and practical difficulties – in ways that bilingual students do not – with a translation project nested in propositional logic.

But a problem manifests for both groups. In a critical reasoning course, where propositional logic serves a foundational role about reasoning and inference, there is a subtle confusion that arises. Using the material conditional, as an example, students are taught that the material conditional and the indicative

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[102] Berlin (1990:79–80) writes, "Words mean, not by pinning down bits of reality, but by having a recognised use, i.e. when their users know how and in what situations to use them in order to communicate whatever they may wish to communicate; and for this there are no exhaustive formal rules. But because there is no single criterion of meaning and no single method or set of rules for testing it, it does not follow that there are in principle no criteria at all, no methods and no rules which may apply in differing types of context and situation." The monolingual's competency is holistic, if Berlin is right, and picking apart reality in a correspondence sense according to translation rules may be difficult and inaccurate.

or strict conditional are not the same thing. However, the material conditional is taught, and its truth conditions are held to be systematically correct, regardless of warnings that the material conditional means something different than the conditional in natural language. If students do not have a clear understanding of the differences they may then write essays containing conditional statements, think back to their translations into propositional logic, and assume they are using a material conditional. From a student's perspective, why else would the material conditional be taught? In introduction to logic at Rio Hondo College, this confusion occurs more often in the bilingual group, who are following the rules of what they were taught and develop a misconception about the truth conditions of a material conditional in natural language.[103] To this end, translation from natural language into the language of propositional logic harms understanding of natural language and its proper use. Berlin (1999:80) confirms these thoughts, "… logical translation continues to be misused, particularly when attempts are made to force propositions, on pain of degradation or even elimination, to conform to some uniform model, and so to rob them of their most important uses and differences."

Simply, if translating the natural language into the language of propositional logic, and its truth conditions for the material conditional had not been part of the critical reasoning course, it is likely that this confusion would have never gained traction. Students, rightly so, believe there is relevance of material in the class and that it is taught for a reason, not simply to be taught because it has been that way in the past. Further, the time spent teaching translation and propositional logic in general, in the overall scope of a critical reasoning course, gives the impression of its importance to students when that importance does not connect with its practical relevance to ordinary reasoning. Thus, the inclusion of translation into propositional logic can have unintended consequences when it is a significant part of a critical reasoning course.

[103] An informal survey of participation denotes that the number of hands that go up and questions asked, is related to the use of the material conditional and why it is taught if it is not the same meaning as in natural language. The previous quote by Berlin demonstrates the issue with the correspondence view of language, which is what propositional logic translation relies on. The lack of correspondence is confusing to students with the material conditional and especially those whose primary language is not English.

Gensler (2010:118–21), LeBlanc and Wisdom (1993:1–17), Howson (1997:5–7), and Nolt (1997:31–35) for instance, teach translation by starting with simple sentences, progressing to compound sentences with the logical connectives obvious. From there, more difficult translations confront the student without the clear logical vocabulary of the defined connectives. Students typically model what their instructor teaches, and follow the same moves. Some instructors translate the subject; others the predicate and both use the corresponding symbol; "Bill is happy" translates as either "B" or "H." The chosen letters in some sense identify the sentence.[104] But this is the specious move in one sense. As syntactic propositional logic is an uninterpreted system (and semantic is only interpreted with truth-values), the only relevant difference is symbol shape difference. Students, however, take that connection as meaningful as a place holder of content, not as a substantive representative of the robust semantic content of the sentence.

While it is difficult to articulate the following, an attempt follows. Ostensively, instructors point to the symbols on the board or overhead, and equate the meaning of the sentence to them. This presentation happens swiftly, with precision. The implication is the symbols have the same meaning as the sentence. Students see the correspondence and the practice is solidified. Little do the students know that the sentence and symbols cannot, however, have the same meaning because the logical system is uninterpreted and any meaning is intrasystematically justified. At best, the instructor is highlighting a paraphrase of some component of inference. There is not much more to it.

The lack of correspondence leads to another problematic point about translation and propositional logic. Syntactic and semantic propositional logic are intrasystematic in meaning. They define themselves in terms of the meaning of symbols and connectives; they define acceptable moves through rule use. If it is a formal system, it stands uninterpreted. When translating natural language into the

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[104] Klenk (2008:28) offers a slightly different translation suggestion: "We will generally use the first letter of the sentence being symbolized, or at least some letter that reminds us of the meaning of the sentence." How does a letter remind us of a meaning of a sentence? The equivalency relationship is an odd one because what is on one side of the equality sign (A = "Alan is home".) is completely different in meaning and seems an odd use of both "meaning" and "equals."

language of propositional language, an interpreted system is thought of in terms of an uninterpreted system–and we have to question if that is correct.

An analogy might be helpful. A spreadsheet is an electronic means of organising data. It does so *per* rules and symbols. Put accounting data into it, such as a balance sheet, it organises the data one way. Enter student grades into it, such as a grade book for a semester, it organises the data in another way. The organisational aspect varies on use. The spreadsheet licences particular moves, but it does not licence all moves. The programming controls the content. Propositional logic, in general, does something very similar, it controls the content in a way that determines particular results. If, for instance, the translation is from an argument on science, ultimately science does not matter. If the translation is from an argument on familial relationships, ultimately the family does not matter. What matters are the intrasystematic moves in syntactic propositional logic, not relevance of content (among premises when relational), not natural language meaning, and not the intent of the argument.

That last phrase might be surprising. The intent of the argument is to provide truth (and/or understanding) but not based on some *ad hoc* translation into a logical system. Propositional logic translations – either semantic or syntactic – do not capture the extrasystematic context of arguments. When the connectives do not have the same meaning as natural language – in particular, the disjunction and material conditional – there is a gap in translation of logical structure and associated truth-values. Thus, representation lacks for both propositional and natural languages.

Truth conditions have connection with the normal world of discourse and thus retain some relevance in translation and practice. But what about the syntactic side of propositional logic? The well-formed formulas or WFFs have different meanings in syntactic propositional logic, that is, they are merely defined by their rule use, not truth conditions. This thesis explains the syntactic rules in terms of natural language, but that alone is an interpretation of an uninterpreted system. The meaning of the WFFs is their transformational role into other symbols, that is, the transformation game. This is a subtle point. Is the basis for natural language meaning its transformation into other symbols? No, natural language meaning is much more complex, as it is extrasystematic. It relies on linguistic relations, context, and use. Syntactic WFFs do not represent these three ideas well at all, if at all, with their own intrasystematic meaning. An objection to this line of thinking is that they do not have to, all they should do is model the inference and learn something from that sequence. How is the inference from natural language modelled, or translated through WFFs and their manipulation? There is not only a translation issue with natural language and WFFs, there is also a translation issue from natural language inference meaning and transformational meaning in propositional logic.

Pedagogically, a crisis may result for the instructor. Does the instructor tell students that translation in propositional meaning captures natural language meaning? If the instructor does, it is more likely due to incompetency or lack of critical reflection than being devious. The instructor is following a pattern of instruction and doing what they were taught or told.[105] Or, does the instructor do the honest thing and point out the differences between the two and accept the consequences of a lack of credibility? If propositional logic is taught as the best or acceptable form of reasoning in a critical reasoning course, an instructor is left with a credibility challenge. Students quickly catch on that natural language reasoning and propositional logic reasoning are different. Once they are taught the propositional system in a course, its use is minimal. The system, more or less, stands alone for further use, if at all.

Course context defines course content and critical reasoning courses differ in context dealing with the nuances of everyday reasoning in natural language, so the content should be different reflecting this priority on natural language. But that is of natural language as it is; without the translation, the dismissed context, and the formal caricature of ordinary reasoning manifested in propositional logic.

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[105] There is another explanation. “Course outline of records” are official documents that document and prescribe the content that must be taught in a course. Introduction to logic outlines were written by faculty, as were critical reasoning outlines. In one sense, this is a higher-level problem as anyone teaching the courses has to incorporate that content. So, the instructor is being “told” what to teach through the course outline of record, which owes it origin to faculty members in the past.

5.4 Formalism is distinct from human reasoning practices

Students' exposure to formal symbol manipulation happens through elementary algebra and geometry. Mathematical systems, by their nature, are the paradigms of formal systems. When done properly students can see the connection between symbolic mathematical and algebraic subjects and the world. But there is always a disconnect. Astute students can solve natural language algebraic problems without appealing to the formal system. With normal reasoning tools and simple logic, the same result is obtainable. Translation problems, like those between formal logic and natural language, manifest in mathematics education, too.

Human beings, being self-conscious, can abstract from their immediate experience and think about that experience, as an experience. The experience can be compared and contrasted with other experiences. Thomas Nagel (1989:4–5) designates this as the subjective/objective distinction. Through self-consciousness, humans individually, have personal subjective experiences but also objective experience. That is to say, humans consider their own personal view in relation not only to other views, but in relation to views *abstract* from all individual views, such as the view of science, or even further, the view from eternity (1986:4–5).

This ability to abstract is the source of formalism. In one sense, the concept of propositions – ideas that are not bound to any particular language – abstract content from any one particular language. A more objective standpoint justifies that languages have the "same" ideas, so a logic of those propositions is what is in order. The next step is to further represent through symbols another abstraction from propositions, particular forms, and relationships. So, there are two potential steps of abstraction at work.

In contemporary propositional logic, the intermediate step, is left out. The idea of a logic of "propositions" is controversial, so understanding the language itself in terms of specific forms and symbols results. In one sense, the propositions add intelligibility to the picture as the intermediate step in translation, as what one is doing is just a general logic of ideas. But the structuring is that a higher-order abstraction represents a lower order abstraction, which then represents natural language.

In either case, whether sentences lead to propositions, which lead to logical form, or sentences without propositions lead to logical form, the result is the same. The abstraction leads to formalism, which is devoid of the content of the original sentences. Nagel (1971:722) writes: “Consequently, the absurdity of our situation derives not from a collision between our expectations and the world, but from a collision within ourselves.” This formalism is the result of the application of self-consciousness to human practice. As humans, this abstraction is taken far more seriously than it should be at times. It may be that abstraction and formalism are just arrogance, personified in the scheme of living things.

However, it is in the nature of education to teach abstraction. Humans seem to value it. And, yes, there are uses for it. Structural engineering relies on the ability to understand higher-order mathematics like calculus. Much of our abstract processes are now automated or calculations done through complex programmes that minimise human error. One way to understand this is that the abstraction no longer matters like it once did, but what matters is the result. The result is grounded in human practice, for instance, whether a building’s floor can support the load.

In the practice of everyday reasoning, the content of the argument is understood in that context. Abstraction producing formalism is an unnecessary step for most everyday arguments, as the context does not dictate this move. Introducing formalism, in the logical sense in this type of context, can lead one astray from the semantic point. Formalism makes sense in mathematical reasoning even in those discussions as the context gives licence to that use. But that context is, typically, radically different than what takes place in our ordinary reasoning practices. Therefore, students need to be taught the limits and scope of formalism and the bias toward formalism as ideal. It is not that formalism *simpliciter* is bad; it is but a tool and tools have appropriate uses. But, formalism and critical reasoning do not share a lot of common uses, especially as formal articulations of ordinary language arguments.

5.5 Formalised deductive reasoning is rarely done naturally

Someone can live a whole lifetime and never formally translate and symbolise an argument. More so, this same person can reason effectively, provide good arguments, and live a good life without propositional logic. This fact should be disturbing to classical logicians as it demonstrates something about the nature of argument in everyday life versus the formal caricatures of propositional logic. It should be equally disturbing to those who teach critical reasoning and include propositional logic as the *deductive standard* of reasoning.

Consider the following argument:

1. Jane's mom has been sick with the flu.
2. Jane has a fever.
3. Jane missed work.

Thus, Jane probably has the flu.

An attempt to put this in propositional argument form might be:

1. S
2. F
3. M

Thus, P

The argument is not a typical deductive argument given the lack of logical language and does not easily translate into propositional logical form. Students who have been taught the deductive propositional apparatus see that it is not a deductive argument, and might conclude it is not a good argument, because it is not deductively valid. Little do they know, however, that the reasoning is almost the same as a medical doctor would use to diagnose someone with an illness like influenza. Looking at symptoms and context, the medical doctor's argument makes for a reasonable inference. Yes, the medical doctor could be wrong, as the truth of the conclusion is not guaranteed by the truth of the combined premises. But would the argument be better if its characterisation (among others) were deductively valid?[106] Such as this formulation?

1. If Jane's mother had the flu, Jane has a fever.
2. If Jane has a fever, Jane missed work.
3. If Jane missed work, Jane has the flu.

∴ If Jane's mother had the flu, Jane has the flu.

Judge the two arguments for contextual relevance. Does the propositional argument in valid deductive argument form have the same meaning as the non-deductive version? Does it capture the same intent? Arguably, they are *different* arguments and it is not clear that the deductively valid one is better than the non-deductive one in terms of plausibility and accuracy.

Many academics across the behavioural and social sciences, mathematics and sciences, and career and technical education would concur that they have never come across any instance of formal, symbolic logical reasoning outside of school or higher education courses. Every semester – upon concluding my introduction to formal logic course (not in my critical reasoning course), students are asked whether they will use propositional logic again? Normally, only philosophy or mathematics majors answer in the affirmative.[107] The future holds, but the impression that the application of propositional logic is limited, if at all, it is substantive. That perception underwrites a legitimate pedagogical concern with

[106] Part of the issue here is what counts as an adequate translation from a non-deductive argument into a valid deductive argument form. The reasons are offered as a group in the first argument and that sets the context for judging the plausibility of the conclusion. The valid argument has a chain of reasoning, but all valid arguments – to some extent – link the premises and conclusion. There are other ways to deductively characterise the argument, and this leads to another translation issue. What is the best semantic characterisation of a non-deductive argument in valid deductive form? There are no obvious rules for that characterisation.

[107] While anecdotal, I've had over 1200 students in that course or a similar one in 18 years of teaching.

the inclusion of propositional logic into a critical reasoning course, especially when the concern is answered in a course just focusing on logical systems and translation like introduction to logic.

The fact that the practice of deductive, formalised propositional logic does not reveal a change in academic or practical behaviour of even those in the academy should be indicative of its veracity as a practical form of reasoning. This is not to say it could not be used if necessary as philosophers do as part of their professional practice, but it does not appear to be necessary for a good life of a competent reasoner. Is this simply a utilitarian concern, such that the argument is only concerned with the practical and not the theoretical? In scope, propositional logic has use in philosophy, as the literature contains the use of the concepts. But critical reasoning courses are general education courses, where students learn skills that transfer not only to their education but to life. Thus, pedagogically, one should question why propositional logic is taught in critical reasoning courses as the correct way to reason.

5.5.1 Pre-propositional logic education versus post-propositional logic education

Pre-propositional logic education students reason effectively. Demonstrating this is straightforward as they function in the world and perform basic logical tasks of inferring such as:

1. The classroom door is locked.
2. No one is in the hallway.
3. Knocking on the door produced no results.
4. It is 20 minutes after the starting time.

Thus, class must be cancelled.

Students have basic inference abilities that are the product of many years of experience with the world, education, and facts of science about how the body works. These natural reasoning practices are sufficient for everyday use. They are not perfect and do not guarantee certainty. But the world is a changing place and ideas must change to fit the world and its changing context, especially when human behaviour is a large part of the equation.

Suppose students take a critical reasoning class that draws a three–way distinction between reasoning: presumptive or defeasible, inductive, and deductive. Presumptive is like the classroom example above, there is a plausibility assessment of the conclusion related to the relevance of the reasons.[108] Inductivism has a logical consequence relation where the truth of the premises does not necessarily entail the truth of the conclusion. Premises vary on strength; stronger premises lead to a greater likelihood of the conclusion being true than weaker premises. Deductivism has the logical consequence relation where true premises must entail a true conclusion. This three–way distinction is important to compare and contrast distinct kinds of reasoning. However, a bias may enter the picture, as an example, Walton (2006:53) writes:

> "If an inference to a conclusion can be supported or refuted very effectively by inductive methods, then the need or usefulness of judging it as plausible or not as a presumptive inference falls away. In general, if an argument can be evaluated on a basis of probability, then evaluating it as plausible or implausible becomes less useful. Methods of plausible reasoning give way to inductive evidence, if it is available. Similarly, inductive evaluation gives way to deductive logic, if it can be usefully applied to a case."[109]

Walton's argument hierarchy of strength runs from defeasible to inductive to deductive, where all can be applied appropriately. With a logical consequence relation, this hierarchy of strength runs in the right direction. But, the question arises about the hierarchy and its role in pedagogy: does this capture what the content should be in a critical reasoning class?

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[108] Walton (2006:18) writes, "Presumptive defeasible generalizations are the least strict, because they are based on what is assumed to be a familiar or typical situation, but one where there is inexact and incomplete knowledge on how things might go."

[109] Walton (2006:71) notes the difference between plausibility and probability. He writes, "Plausibility is different from probability. Probability is determined by collecting data on the statistical chances of what happened, and then using that data to judge how likely a statement is to be true. Plausibility is a matter of whether a statement appears to be true in a normal type of situation that is familiar both to the participants and the onlookers."

Suppose students are taught deductive propositional logic as the proper way to reason by the hierarchy. They learn truth tables and the values of the connectives/operator, and maybe proofs. They are taught principles of inference like conjunctive syllogism, disjunctive syllogism, *modus ponens,* and *modus tollens*. They are also taught the formal fallacies of denying the antecedent and affirming the consequent, and Walton's hierarchy for application purposes and they have obtained a new set of tools and understanding.

Accordingly, with the hierarchy in mind, students evaluate arguments, remembering that deductive arguments are the "best" in the hierarchy. They were also taught that propositional logic is the proper expression of that type of argument. As arguments go in everyday life, they realise that the argument does not fit the deductive structure, nor is it inductive as probability or likelihood is not part of the calculation. So, the students characterise the argument as a defeasible argument. But in the back of their minds, they think that the argument is not a good one because it falls last on the hierarchy. This pattern repeats for ordinary arguments.

In ordinary experience, there are inductive arguments, but rarely are there deductive arguments that can be put in propositional form and evaluated for either semantic or syntactic validity. Eventually students cognise that propositional logic's deductive arguments are rare. They may begin to wonder if they are doing something wrong, surely, they must be more common as their critical reasoning instructors spent a great deal of time teaching this form of argument. No, the reality is that propositional logic does not have a lot of import to their ordinary reasoning experiences and they seem to get along fine without it. But, they also recognise that they cannot get away from their ordinary reasoning and its own importance.

Pedagogically then, what should the response be of the critical reasoning instructor? Post-propositional logic education did not benefit the student practically as it did not give a skill set that is effective in daily life. The hierarchy sets students up for anticipating that propositional logic—especially when taught as the exemplar of deductive logic, is useful, when particular conditions hold, and the result will be stronger than the other two types of arguments. In contrast, the response should be that while the logical consequence relationship is different, different contexts need different arguments. There should be no argument hierarchy in the pedagogy of critical reasoning, so the application of concepts for the student is bias free. More so, propositional logic, is likely further to the “strong” side of the hierarchy than simple valid deductive arguments in natural language or even syllogistic arguments. From the critical reasoning perspective, propositional logic is a caricature of deductive reasoning with its symbolic form and connectives that differ from natural language meaning. Hence, in a critical reasoning course teaching something about deductive and inductive arguments is necessary. But, the context of use should be the message driven home to students and without a bias toward arguments based on the difference in a logical consequence relation. This effectively orients students’ post-propositional logic education. Practically, students will then use the argument type needed to provide good reasons for a conclusion in the appropriate context, which I propose to be reasoning in everyday life.

5.6 The ideal of formal reasoning is not the “ideal” for critical reasoning

Reasoning abstracted from human experience might reveal an ideal along the thoughts of Plato’s simile of the line in the *Republic* (1961:509d–511a), where the physical world is secondary to the intelligible world, which is accessible through the mind alone. Mathematics is part of the intelligible world, as is formal logic. The roots of an ideal, especially as it relates to mathematics and the forms comes from Plato and his influence is still being felt through this emphasis on the abstract being “pure” instead of “clouded” by reality. This “cloudy” nature is an unfortunate consequence of an idealistic metaphysic.

Critical reasoning is, by its nature, “clouded” by human practices and a changing practical reality. The argument that follows in this section exposes various problems with propositional logic as an “ideal” with respect to critical reasoning and its pedagogy. This includes the tension with two types of validity, informal and formal. More so, truth functions in practice follow validity judgements, which the latter seem disconnected from in ordinary arguments. The two-step procedure of assessing validity and then soundness complicates argument evaluation unnecessarily.

5.6.1 Validity and truth functions in practice

Students who are taught a typical definition of deductive validity – if all the premise(s) are true, the conclusion must be true – should understand the hypothetical nature of the definition. The “if” aspect of the definition of deductive validity functions to test the structure or form of the argument. In a practical sense, this logical deductive structure guarantees the transfer of truth from the premises to the conclusion. So, the validity test is one logical structure or form, and not the semantic content of the premises. But this conception of “validity” is overstated and carries two conceptualisations thereof.

There is a subtle move that goes with an appeal to formal deductive validity. Those learning propositional logic still considers the content of the natural language sentences in form. But the semantic content is irrelevant to addressing the structure of the argument in a valid formal deductive argument. What might be a better definition would be along the lines of: if the logical form(s) of the sentence(s) is true, the logical form of the conclusion must be true. Thinking about *modus ponens*, the structural form is: a conditional, affirming the antecedent of the conditional and then affirming the consequent of the conditional. In other words, when there is a conditional, its antecedent, the consequent follows, regardless of content. This is a structural interpretation of formal validity, or propositional logic validity.

This interpretation of propositional validity is distinguished from an appeal to “informal” validity. A simple argument:

1. Scott is 6 feet tall.
2. Bill is 7 feet tall.
3. 6 is less than 7.

∴ Bill is taller than Scott.

This argument has no obvious logical or structural form like *modus ponens*. However, the argument is deductively valid. Without the obvious logical form that guarantees the transfer of truth from the premises to the conclusion, the content of the premises must do the logical work to secure validity. Informal validity looks much more like the initial definition, where if the content is true in the premises, the content in the conclusion must be true as well. Therefore, validity with deductive arguments appears to be of two kinds: formal and informal.

Informal validity has a place in critical reasoning as it considers the semantic content of the premises in determinations of validity, in some degree not found in the formal sense of validity, which is only about logical structure. The semantic content is important, as critical reasoning is not entirely abstract and provides traction for understanding. This is where *logica utens* informs *logica docens*.

But both kinds of validity, however, suffer from another problem with abstraction: the role of hypothetical judgements in everyday life. On any definition of deductive "validity" a hypothetical judgement is made about an argument, whether to assess a semantic or syntactic necessary connection. How often are hypothetical judgements in use in everyday life? Take the earlier argument about "class being cancelled." Would taking that argument hypothetically to test for deductive validity add anything to the argument making it a better argument? Hypothetical argument tests distract from the relevant issue of the value of the argument, whether it is good or bad. "Good" or "bad" here concern the relevance of the premises to the conclusion, and their relationship to the world and common knowledge. This is a very important point because a formal or informal valid deductive argument can be a bad argument. For example:

1. Bill weighs 100 kgs. or Barack Obama is Russian.
2. Bill does not weigh 100 kgs.

$\therefore$ Barack Obama is Russian.

The argument form is disjunctive syllogism, which is valid under the formal definition of “validity.” By an ordinary assessment, it is a bad argument because the content of the argument is false and it is irrelevant to almost any context.

On the paradigm of propositional deductive validity being the ideal standard for articulating the relationship between the premises and conclusion, “validity” is an evaluative concept. “Soundness” is as well, ascertaining the truth of the premises. But it is a two-step model that is inefficient with ordinary natural language arguments where judgements of semantic and truth relevance are made rather quickly. Validity judgements might be a waste of time supposing someone concludes it is not a valid argument. Does one then try to force it into a different deductive form and reassess? Or does one think of it in a defeasible way and continue with assessment? In either case, simply skipping the validity test would allow a relevance judgement about the argument that for practical purposes may be all that is needed.[110]

As Walton (2006:52–53) writes about the hierarchy of arguments, one should try, when available, to use the deductive form of argument given its necessary consequence relation. Walton (2006:52–53) is correct in one sense of the hierarchy: do not use logical machinery until you need to, and this should be taught to students. If evaluating an argument follows from just assessing its premise and conclusion relationship in terms of plausibility, why even consider using formal or informal validity, or even inductive strength? This strategy could allow room for the hierarchy but in the way of assessing what is most common in argument, in the most straightforward way from everyday human experience. Using hypothetical tests in contexts that do not warrant it defies the effectiveness of everyday argument in providing understanding and even persuasion in the world. Those learning the concepts then use what they are most familiar with and may confidently assess the argument unless there is a reason not to.

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[110] Throughout chapters four through six, I use “may” and “might” and other words to qualify statements. Some may see this as waffling; however, the thesis itself takes into account that context matters and exclusive statements just repeat the problem of using propositional logic as a way of critical reasoning. Context matters to relevance and is not subject to definitive rules of structure or content.

Philosophers often use abstract thought experiments, such as in ethics and metaphysics. The trolley problem (Thomson 1985:1395), for instance, where one considers the appropriate action of whether hitting one person or five people with a runaway trolley relies on thought experiment and hypothetical situation. The value of these hypothetical abstractions to the philosophical enterprise has significance; but to critical reasoning the value is questionable. The latter must have traction in the world of human relations and improve real-world argument articulation and evaluation. Pedagogically, addressing this traction early in a critical reasoning class, keeps students focused upon relevant arguments from everyday life in contrast to mental exercises generated by hypotheticals.

Hypothetical assessments, like formal and informal validity, miss the mark in most ordinary reasoning contexts except in cases of assuming counterfactual conditions. Suppose most evidence points to “Person A” as the person who committed a crime. “Person B” has some evidence but not enough to convince, given what holds for “Person A.” Supposing a counterfactual condition, as well as the current evidence against “Person B,” may demonstrate the relevance of that piece of evidence to the situation, or if “Person B” should be taken more or less seriously. So, hypothetical assessments are a tool having a context for use, but whether they are necessary for argument in general through validity justifications does not follow.

Pedagogically then, care must be taken when entertaining any definition of “validity” in a critical reasoning course, as both introduce a hypothetical abstract situation, with the argument suspended from the practical world of human experience. Consequently, instructors must be on guard for the bias toward validity, as if it has something important to claim about everyday arguments related to human experience. This is even more so when using propositional validity as articulating something about normal reasoning practices, when there is no clear connection. While deductive validity is an extremely important concept in introduction to logic courses, it does not retain that significance in critical reasoning courses, and introduces potential hazards into the curriculum.

One such hazard is the formal fallacy of affirming the consequent. By propositional logic, this argument is invalid:

1. $(P \supset Q)$
2. Q

$\therefore$ P

Either through semantic and syntactic assessment, the argument is invalid. This is a general judgement of its formal logical relations alone. Deductively, through the "invalidity" label, students believe this argument form is deeply flawed.[111] Yes, in propositional logic, the result is a flawed structure. Consider the following natural language argument in affirming the consequent form:

1. If *h pylori* is bacteria, then antibiotics kill *h pylori*.
2. Antibiotics kill *h pylori*.

$\therefore$ *H pylori* is bacteria.

This is a singular instance of the problematic form and logical relations. The argument is a good inference in terms of relevance and rationality. The general logical implicative form and a singular semantic inferential instance conflict in logical evaluation, as the general logical form is invalid but the singular instance is rational in terms of semantic inference. The question arises, should this argument be simply labelled "invalid" due to its problematic propositional logical form, or should the argument's assessment consist of its semantic content connection (and its truth-values) without regard to form? More importantly, the singular instance is one instance of many with the use of this argument form in ordinary reasoning, where a causal relation exists (or appears to), the effect is known to be true, so the cause must be true as well. The reasoning is from effect to cause.

[111] But, pedagogically the assessment of "invalidity" is only clear if one understands the truth table or system of implication. It is not obvious to someone who does not have a formal logical education.

Semantic content links the effect to the cause regardless of the logical structure. Thus, the conflict is one of semantics versus syntax.

Pedagogically, students must understand the charge of "invalidity" and how it applies in the context of propositional logic and is limited elsewhere. Implication and inference are different. Even the notion of "fallacy" here poisons the well against singular instances of the form with rational semantic content and inferences. Invalid implications in propositional logic may be good inferences in other contexts and it is the job of the critical reasoning instructor to present various arguments as acceptable, given contextual considerations. Most ordinary language arguments have semantic content that links the premises to the conclusion, so criticisms of logical form are not always appropriate. These subtleties of reasoning and application are the domain of critical reasoning pedagogy and should not be eschewed for generality via the concepts of "valid" and "invalid." Life is general, living is not, so singular applicative instances matter.

5.6.2 Monotonicity v. non-monotonicity

The traditional logical consequence relationship is monotonic (Strasser and Antonelli 2016). A monotonic relationship between premises and conclusion is when additional premises do not change the conclusion. In contrast, a non-monotonic relationship between premises and a conclusion is when additional premises can change the conclusion (Strasser and Antonelli 2016).

Suppose both consequence relations, $\alpha \vDash \beta$ and $\alpha \vdash \beta$. With the addition of premises to the existing premises results in $\alpha \cdot \gamma \vDash \beta$ and $\alpha \cdot \gamma \vdash \beta$. The fact that γ is added to the existing premises and the conclusion or result does not change shows that both relations are monotonic. Contrastively, suppose both consequence relations, $\alpha \cdot \gamma \vDash \beta \vee \theta$ and $\alpha \cdot \gamma \vdash \beta \vee \theta$. The fact that γ is added to the existing premises and θ is added to the conclusion indicates that both relations are non-monotonic. While the consequence symbols remain the same, the non-monotonic consequence relation is different given how the additional premise(s) manifest in a different conclusion.

Propositional logic implications and "arguments" are monotonic. Additional information still entails the same conclusion. In this sense, a single argument is not subject to revision if additional information is available; instead, a new argument must be made to include the additional information and possibly new conclusion. This process is different from how humans naturally reason when additional information is available. Non-monotonic arguments are defeasible arguments where additional information added to the premises may lead to a different conclusion(s). This form of argument is dynamic and ever-changing with additional information, as new conclusions can follow. Monotonic arguments are implicative, rules determine the result; non-monotonic arguments are not, they are inferential where beliefs determine the result or results.

In the context of critical reasoning, non-monotonic arguments fit a bigger picture of inquiry. An argument model is only as effective as the person using it competently and for its proper purpose. Someone engaging in an inquiry is an inquirer who should possess a few basic characteristics. There are three characteristics that are important to delineate. If someone were to fail on any one of these, communicative disruptions like disagreement, misunderstanding, and/or alienation may take place. All three come from Cherniak's (1981) work on minimal rationality. The first one is the basic rationality principle: if a person has a particular group of beliefs and desires, the person would undertake some, but not necessarily all, of those actions that are appropriate in the context (1981:166).

The basic rationality requirement ensures that a person operates from a belief set. To understand someone's belief set, is to determine what actions that person might perform in that context. Owing to a shared worldview, we understand that most of us make sense of each other's actions and what we might do in particular contexts. However, imagine someone who acts outside of one's belief set, or does not perform any of the actions that are appropriate in the context. The person's rationality might be challenged. Considering this basic structure of shared worldview, reasons can be added to arguments resulting in new conclusions as part of ordinary reasoning practices.

The basic rationality requirement also is considerate of diverse cultures and groups. Rationality is defined by a particular group of beliefs, and, as is commonly known, diverse cultures believe different things. This is a very important point. The basic rationality requirement permits us to understand their beliefs as something distinct from ours, understand their actions, and make adjustments that hopefully facilitate understanding, which is another example of non-monotonicity.

The second requirement is the basic consistency principle: if a person has a specific group of beliefs and desires, then if any inconsistencies arose in that group of beliefs, the person would sometimes eliminate some of them given the context (Cherniak 1981:172–173).

The basic consistency requirement ensures that a person does not adopt radically inconsistent beliefs and seek to maintain them. Sexism is a belief that is inconsistent in many people. A person might have a general position of being a sexist; yet, knowing someone from another gender/sex, the person may exclude them from the category of derision. So, the person believes a particular sex is inferior, but not this one representative of it. The basic consistency requirement would challenge one of those beliefs and require revision for consistency’s sake, which is another example of non-monotonicity in belief and argument revision.

The third requirement is a basic inference ability such that: if a person has a particular group of beliefs and desires, the person would make some, but not necessarily all, of the correct inferences from that belief group that are appropriate in the context (Cherniak 1981:167).

The basic inference ability requirement ensures that when someone is operating from a belief set, the person makes appropriate inferences. Someone may not make the best inferences but can make appropriate inferences. Rethinking the “class is cancelled” argument from 5.4.1, another inference is that the class has gone to the library or another classroom due to computer problems. With additional information added to the current belief set, remembering that the instructor mentioned something about the library, leads to a different conclusion, which is an example of a non-monotonic argument.

How do these characteristics function together? Someone who is rational will make appropriate inferences and minimise inconsistency. Imagine someone is at work, smells smoke and hears an alarm. The person will infer that there is a fire and that leaving the building might be an excellent idea. Another inference might be to call the fire department. Someone who is irrational might make inappropriate inferences and not care about inconsistency. Consider a person who is at work and smells smoke. The person knows that smoking in the building is not permitted but attributes it to someone smoking. The smoke gets heavier and heavier so the person infers more people must be smoking. That inference given the situation is irrational. While an example of irrationality, it does not necessarily mean the person is irrational in all areas of life. Some people are more irrational than not, and they may be mentally ill or children. Children normally do not have a large enough belief set from which to make appropriate inferences, so they make inferences outside of the belief set and infer incorrectly. The same can be said for mentally ill persons who infer irrationally from a limited belief set. Consistency is the last thing to be worried about along with correct inferences for these kind of latter cases as personal safety matters more.

Pedagogically, for critical reasoning courses, inquiry and the traits of an inquirer, form a relationship with the world. Non-monotonic arguments best express this relationship and the ways that an inquirer uses information and draws consequences that may require additional information, and different conclusions. This whole picture of inquiry and non-monotonic logic integrate in a way that is not so obvious for monotonic logic with static premises and no consequential change, with the addition of premises to the argument. Critical reasoning does not take place in isolation like propositional logic and its monotonic variants. Without a pedagogical emphasis on non-monotonicity, students are not given expressive tools focusing on natural language arguments, the relevance of their reasons, explanations available, types of arguments, for example, testimony and analogical, and plausibility judgements.

5.6.3 "Explosiveness" in ordinary and natural inconsistencies

The taught propositional logical results of ECQ and EFQ lead students to believe that a contradiction leads to disastrous results in systematic integrity. The characterisation of ECQ and EFQ as something to be avoided is taught through logic textbooks, such as Nolt (1987:66), but it is not obvious to students why it is bad. Both ECQ and EFQ are explosive, i.e. that from a contradictory premise which is false, anything follows from the contradiction in classical propositional logic. Thus, students are taught that ECQ and EFQ result from a contradiction, so they should avoid contradictions.

Students are typically unreflective on explosiveness. They may believe the results in formal logic but do not necessarily carry that conception over to their own practices.[112] But the seed is sown that contradictions are bad. To be clear, in propositional logic, contradictions have a result that may or may not be problematic. Contradictions are WFF's and follow the rules, so any characterisation of them as "bad" arises, extrasystematically.

As Tarski (1944) and Priest (1984) both demonstrate, semantic closure of natural language causes natural language to be inconsistent. The obvious manifestation of this linguistic phenomenon is the liar paradox, or linguistic paradoxes of self-reference (Priest 1984:126). It is a logical feature of natural language where predicates and self-reference interrelate and produce a confusing result. But this is the logical consequence of natural language meaning, in particular in the English language (1984:128).

Pedagogically, a discussion of the liar paradox, e.g. "This sentence is false" – if the sentence is false it is true and if it is true it is false – might consist of the paradox and some solutions to it. But articulating the larger linguistic picture is not a priority for most instructors. The lack of presentation of the context is unfortunate because the liar shows that explosiveness, at least in natural language, is not relevant to every context. Natural language retains its intelligibility

[112] Woods (2003:12) notes the counterintuitive nature of the results of ECQ.

even with a demonstrable contradiction. The proof for this is that this very sentence makes sense, for if the contradiction infected the linguistic system, we would not be able to understand what is being written. As Priest (1984:126) also notes, “Moreover any adequate account of the semantics of English will have to face semantic closure and the existence of contradictory truths.” Instructors should point out that the limit of explosiveness is system related and English remains intelligible regardless of the logical results of EFQ or ECQ.

Another ordinary example of inconsistencies in everyday life is the law. Amit (2006:275–300) details how interrogation becomes torture through various physical, emotional and psychological means. Torture is forbidden by law; interrogation is not. The same actions, to some degree, are used in each. The higher court reaffirmed that torture as a general principle was forbidden, yet no specific instances were acknowledged to fall under that general principle. However, no one believes that those inconsistencies make the whole body of law flawed, which would be “explosiveness” in practical effect.

Pedagogically, instructors need to be cautious when teaching both “explosiveness” and that anything necessarily follows from a contradiction. Nevertheless, for propositional logic, the awkward result which follows is damning: propositional logic is not the structural model of natural language, and its results should not be taught as applicable universally where a contradiction exists. More so, if propositional logic is not taught in a critical reasoning course, students may not be exposed to formal logical results that have little bearing on practical reasoning in everyday life. This is probably the more crucial point that chosen content should not develop misconceptions about inconsistency. There are plenty of practical problems with inconsistency and what follows from it, without introducing caricatures of reasoning that have results that empower confusion, rather than resolving it.

5.6.4 ECQ and EFQ are not principles of inference

Consider two examples of logical implication, *modus ponens* and *modus tollens*. From their modelling as implicative transformation rules to principles of inference, they are taught as valid deductive ways through which – supposing particular premises – a certain conclusion can be reached. The belief in the premises and the intent of reaching a certain conclusion underlies the use of principles of inference. The use of *modus ponens* (MP) and *modus tollens* (MT) does not rely on propositional logic, and thus they are general principles of inference.[113]

The conception of ECQ and EFQ in this thesis, explains that both conceptions are relative to propositional logic. The former from the syntactic side, the latter from the semantic side. Neither contains any flaw in terms of intrasystematic meaning. Any flaw is extrasystematic in meaning, which supervenes on the propositional logic result.

Both ECQ and EFQ are taught as “quasi” principles of inference, such that from a contradictory sentence, any sentence can follow. The use of “quasi” is on purpose because neither fits any general principle of inference conception. Principles of inference bring about a desired conclusion. This use is intentional. However, it is hard to imagine why anyone would want to obtain the proverbial “flawed” result in an intentional way. Another use may be that somewhere in an argument, a contradictory sentence arises, and the person uses the contradictory sentence and ECQ/EFQ to demonstrate that something has gone wrong and leads to an absurd result. The problem with this use is that it violates monotonicity. A contradictory sentence added to an existing proof should not change the logical result, unless one discards the monotonic consequence relation or gives an unwarranted priority to the logical effect of a contradiction.

MP and MT, for instance, are positive uses of implication rules. Through implication, both manifest a desirable result that is rationale based, on the proper application of rules. As implication patterns ECQ and EFQ do not bring about a desirable result, in fact, they highlight an undesirable result for the classical logician. Even more so then when ECQ and EFQ are understood as principles of

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[113] To be clearer, MP and MT are implicative rules (transformations, propositional logic dependent) and general principles of inference (arguments, ordinary language).

inference; there is no reason to use them in this manner, for the intent is different: one is positive, the other negative.[114]

Pedagogically, instructors who teach ECQ and EFQ should understand the hazards of taking an implicative transformation in formal language as indicative of reasoning in general.[115] When ECQ and EFQ are thought of in terms of argument, the “flawed” conception exhibits an interpretation of the transformation from formal language. This is but one conception. Remember that from a contradiction, through conjunctive simplification, either conjunct is inferable, so no “flawed” result. The same move is available in argument, if one chooses to use it. Instructors must make a clear distinction between the direct results of a contradiction, and the indirect results when a contradiction is put into a sequence along with a disjunctive syllogism. The latter is equally “guilty” in some sense in generating the “flawed” conclusion. Instructors, who teach these concepts must also take care in presenting ECQ and EFQ in a critical reasoning course without saying more about the interconnections of contradictions, intent, and context.

Wittgenstein’s sage advice (1973:§125) about not being so much concerned with the contradiction, but the procedure that led someone to a contradiction falls on deaf ears. If an instructor chooses to present ECQ and EFQ in a critical reasoning course, the articulation of the logical background is necessary. Trying to demonstrate ECQ or EFQ as a “quasi” principle of inference from ordinary language does not make a lot of sense because the explosive nature of the logical consequence relation is not apparent. It is only when the formal logical results are known that the context is right for student understanding of part of the issue but not the whole issue as a principle of inference.

One must question, however, any pedagogical emphasis on ECQ or EFQ in a critical reasoning course. A more important conception of contradiction comes

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[114] Previously, I asserted that formal systems are value neutral. This paragraph highlights the problem with thinking that they are not. Contradictions are not bad or good; they are just WFFs and any derivation using them is only applying rules of the system.
[115] Harman (1986:16) is an example of this when he states: “The danger is that, since inconsistent beliefs logically imply anything, if one is not careful, one will be able to use this fact to infer anything whatsoever.”

from Aristotle (1971) in *Metaphysics Gamma*. Supposing that one accepts that ECQ or EFQ demonstrates a formal flaw in the contradictory pattern, one needs to see that this flawed property is not responsible for the communicative difficulty Aristotle (1971:23–25) offers in *Metaphysics Gamma* 1011–1023 as the practical rationale of contradiction avoidance. He asserts:

> "It has been now fully enough stated that the opinion opposite assertions are not simultaneously true is the firmest of all..."(1971:23).

Avoiding a contradiction in a formal system simply means not using it or getting rid of it, if one arises. But, supposing someone uses it and reaches the "open-ended" or "flawed" characterisation, is this the same problem as Aristotle had in mind? Aristotle's main concern was communicative intelligibility and contradicting oneself in speech pushes the boundaries of intelligibility (1971:23–26). This is the everyday conception of contradiction. If the classical logician thinks ECQ or EFQ represents this communicative property about contradiction, one is returning to the confusion of ECQ and EFQ as principles of inference. So, what then is there to say about this other conception of contradiction and why it is different?

With pedagogical considerations in mind, Aristotle's genuine insight about contradiction is that a general idea of contrast, or antonymic meaning, goes hand in hand with human linguistic competency (Aristotle 1971:24). For instance, by being able to discern where "dog" is used versus "cat," requires the ability to contrast only what the two words mean and where they might be used *correctly*. Asserting "dog" and "not-dog" in the same instance and sense does not have a correct usage, nor does it have any clear meaning. Contrast only works when the users understand the lexicon. For example, a child can read the words, "wax paper" and "tissue paper" but not understand the significance of each, which entails the child cannot correctly contrast them. Meaning, contrast, and linguistic competency all go together, which is just a broad restatement of Aristotle's point. Since these three are arguably dependent upon one another, breaking the circle with a contradiction harms our communicative process. This communicative enterprise is fundamental to critical reasoning and should serve students well in informing them of the problem with contradiction without confusing them with ECQ and EFQ.

5.6.5 The incoherence of teaching formal logic (propositional) and informal fallacies

Cederblom and Paulsen's textbook *Critical Reasoning* (2005) details propositional and syllogistic logic in chapter 5. In chapter 6, they provide their account of fallacies (2005:154–190). To their benefit they are consistent and attempt to carry over formal concepts to fallacy explanations, such that fallacies are bad arguments, with bad logical form or untrue premises (2005:154–190). By showing an underlying logical structure to fallacies, both formal and informal, they link to the previous concepts of propositional and syllogistic argument.

This raises the question of the relationship between informal fallacies and argument. In one sense, argument and fallacies are interrelated in a strong way with semantic content being the cause of most informal fallacies. In another way, when an argument is construed in a formal way with symbols, truth functions and inference rules, the structural significance takes precedence over the semantic content.

Natural language argument form (versus content) is going to say little about fallacies unless they are formal fallacies. Denying the antecedent and affirming the consequent are two formal fallacies that receive the most attention. A previous discussion displayed how the logical form of affirming the consequent can result in a good argument while being an invalid proof. This basic tension between implicative forms and argument in everyday life exploits the syntactic/semantic distinction. It seems the same would hold for most, if not all explanations of fallacies in terms of argument form: they would fall short of explaining the relationship and context of semantic content. Typically, fallacies are not necessarily deductive in form unless they are formal fallacies. To characterise them in a deductive sense, when that form is dubitable, does not do justice to most of them given their semantic basis. A minor side point, is that it is not that interpreting fallacies as deductive argument forms is not doable, but rather whether interpreting them in that way represents the semantic content issues in a robust manner. The same problems for translation manifest again as to whether an informal fallacy could be correctly schematised into formal language.

There is, however, a much larger pedagogical issue looming over fallacies. When propositional logic is taught in a critical reasoning course, students are sent the message that formalism leads to clarity and truth. Teaching this particular deductive system shows students how reasoning “should” be done. Outside of translation, not much is in the offering in natural language. Usually there is some additional content about persuasion, inductive arguments, and fallacies. Fallacies oftentimes tend to be the natural language part of the course. The implication is that if the student uses propositional logic correctly, fallacies should not be of much concern, for the focus is to be on learning the *ideal of reasoning*.

Students must be constantly reminded that fallacies are contextual; they are not universal. Teaching this in relation to formal propositional logic leads to the idea that the form and content together produce a fallacy. But, it is not so simple. There are two general views on fallacies: universal and contextual. A universalist about fallacies believes that no matter the context, a fallacy is a fallacy.[116] Reducing them to logical form and deductive patterns reinforces this interpretation. A contextualist about fallacies believes the context (and other factors) can determine whether something is a fallacy or not. Consider the fallacy of appeal to force; when someone uses physical intimidation to get another person to accept a conclusion or a position, the person is guilty of the fallacy. Think about the following example, and the two interpretations that follow to see the difference between the two general views.

Scott: Stay out of the street Julie!

Julie: Why?

Scott: Because I said so!

Julie: So…

[116] An example of this would be Cederblom and Paulsen (2005:154–190) with their linking of deductive arguments to informal fallacies. The very nature of deductive argument forms makes logical fallacies universal.

Scott: If you go in the street again, you will be punished.

The universalist asserts that Scott has committed the fallacy of appeal to force, because, instead of giving reasons to Julie to stay out of the street, he sought to intimidate her into a particular behaviour instead. The contextualist asserts that Scott has not committed the fallacy of appeal to force. Since Julie is his daughter, and Scott is responsible for her wellbeing, he does not have to give her reasons; but instead can appeal to authority and force to keep her safe. The universalist about fallacies is worried about pure inquiry and the persuasive effect of reasons. The contextualist about fallacies has a broader concern in mind, that is, to take into account relevant social and physical dimensions of human experience. The contextualist also believes that reason is not always persuasive due to other factors, including context, emotions, and other elements of the human condition.

The important thing that students need to learn about fallacies is not so much about being a fallacy hunter; but, recognising that something has gone wrong with the reasoning. Forcing informal fallacies into propositional deductive form mischaracterises the semantic content and likely the intent of the person making the claims. It is more important to that end to remember the content of the fallacy, much more than the labelling or even of the argument type.[117] And, that is the goal: not to get into the informal fallacy landscape at all. This is accomplished by demonstrating multiple examples of good reasoning in ordinary language. In contrast to the good reasoning examples, students notice when reasoning is not quite right, and articulate it in terms of the language of argument.

A final pedagogical problem arises when propositional logic is taught as the ideal of reasoning and fallacies are the non-ideal of reasoning: a gap exists in the practical psychology of everyday reasoning. It is the rare case that the human cause of fallacies receives much attention but students need to be aware of how they originate. A fallacy is a mistake in reasoning or argument, occurring through

[117] While I can appreciate the attempt to characterize informal fallacies as flawed deductive or inductive arguments, both characterizations miss the fallacious element, which are the natural language semantic errors. Often, to address a fallacy, claims are reworded to change the semantic content and make them less objectionable. It is because of the content that fallacies can be persuasive, not the argument form, thus addressing the form misses the mark.

insincerity or incompetency.[118] The word “mistake” was chosen intentionally: people commit mistakes for assorted reasons, some known, and some unknown. So, fallacies can be motivated purposely or not.

One cause of a fallacy is “insincerity,” i.e., when someone is consciously trying to be deceptive through reasoning. This motivation is psychological and practical. The overarching reason is normally something like wanting to win or be successful in the argument. An example may be attorneys who reason fallaciously to convince a jury in order that they may win a court case. Another cause of fallacies is incompetence, which manifests when someone goes beyond, or tries to extend, normal, everyday reasoning competency into an unknown area. This commonly occurs when someone has a gap of varying degrees between what someone knows and what someone believes. There is a temptation, given the nature of reasoning, to extend that reasoning into irrelevant contexts.

“Incompetency” is of special interest to pedagogy. On the model where, informal fallacies are translated into deductive propositional argument forms, an additional level of competency is needed. Students not only have to understand the appropriate informal fallacy; they also must understand how that informal fallacy translates into deductive argumentative form. The relationship between the form, the fallacy, and the semantic content, requires a special competency, that is likely unnecessary for fallacy understanding. Instructors who adopt this explanatory approach to fallacies burden students with logical machinery that does not aid in understanding the semantic problems leading to the fallacy or the overall conception of the fallacy.

Pedagogically, when propositional logic is taught as the ideal form of reasoning, its extension into explaining informal fallacies lacks the focus on the semantic content. Even when the extension does not take place, and informal fallacies are the ordinary language component of a critical reasoning course, the contrast between formal logic and informal fallacies shows little conceptual

[118] This is my own definition of “fallacy.” I used the concepts from Wright’s (2001:267–285) on testimony arguments, and applied them to fallacies.

continuity of the course content, which proper pedagogy demands. Instructors who choose to use propositional logic in a critical reasoning course must make every attempt to incorporate the formal system into everyday practical argumentation, which includes fallacies. Note, however, that in an introduction to logic course, the conceptual continuity is easier to maintain given the transitive nature of formalism. Critical reasoning courses have no such conceptual transitivity with formal logic, and informal fallacies, for being contextually sensitive, they are conceptually undermined when associated with propositional logic in content. The hazards of pedagogy manifest in student confusion and are avoidable with conceptual continuity and forethought about practical relevance.

5.7 Teaching the wrong direction of understanding

Languages are means of thinking and communicating. Natural languages are among the common communicating medium for humans. Competency in natural language varies, with a basic competency that allows communication and an advanced competency that allows refined communication. In one sense, competency is related to time, but in a separate way, it is the years using the language that matters (or language age) and not one's chronological age. Language age when combined with self-consciousness allows abstraction and reflection on linguistic content and logical form. Formal languages originate from this abstraction and reflection on natural language. They do not simply come from nothing.

Critical reasoning courses assume the robustness of natural language. The subtlety and fine-grained distinction of natural language contains its own unique set of issues. Instructors, whose linguistic competency is usually greater than their students, already have a language gap of sorts, and must bridge the gap between basic and advanced competency. Part of the pedagogy of any higher education course is to raise the linguistic competency of the students, especially in discipline specific language. Accordingly, there are a myriad of issues, basic and advanced competency in natural language, and discipline specific language that varies from basic to advanced, too. Discipline specific language is both natural and formal.

One supposition with the use of propositional logic is that it is discipline specific to critical reasoning. Students learn the language of propositional logic and achieve a basic competency. Students who continue with predicate logic and metalogic acquire an advanced competency. The value of this for students is a thorough understanding of propositional logic and an application of a formal language. Students should do the work of translations, truth tables, and proofs to achieve competency.

However, the problem with believing propositional logic is discipline specific to critical reasoning is that students can achieve proficiency in propositional logic and yet not improve their critical reasoning skills, such as informal inference and relevance judgements. Learning to ascertain the relevance of semantic content and context to reasoning practices is divorced from the intrasystematic propositional reasoning practices. The truth functional and implicative moves that take place in a formal logical system are different from those in everyday life, or by way of ordinary reasoning practices. But there are two bigger issues at work here, especially with respect to formal and natural languages.

Formal logical languages are limited in meaning and application. They are caricatures of natural language in varying degrees. Their goal is to express something about relational elements in natural language. While that alone is not necessarily bad, what is bad is when the expressiveness of natural language is thought of to be contained by the formal language. This is where the error lies for critical reasoning. Formalisation of arguments into symbolic form can never capture natural language meaning in principle or practice. This is further confounded by logical connectives that are different in meaning from their natural language counterparts. Thus, there is a general translation issue from meaning in natural language to formal logical language and a specific one for natural language meaning to propositional logic and its logical connectives. The formal language is never fully expressive, and not expressive in the right sort of way for critical reasoning practices.

Another issue, which is obvious in one sense, but not seriously thought about in another is the direction of meaning. The only way a formal language obtains meaning is through a natural language. The intrasystematic moves are understood through natural language first, and then as logical moves second. This is a direct challenge to the idea that formal logical systems stand uninterpreted. One uncomplicated way to see this necessary direction of understanding is by considering the definitions of the system itself: symbols, operators, connectives, rules, and punctuation. None of these components of a formal language are defined in an intrasystematic sense and for them to be understood as such, a higher-level explanation is in order. Consider the definition of a well-formed formula: a component and its negation are well-formed formulas, along with any two component well-formed formulas brought together with a connective and pair of parenthesis is a well-formed formula, too. That explanation is in natural language, not formal language. In every discussion – outside of using obvious ostensive measures – the formal language is through natural language and its concepts.

If the previous thoughts are correct, the pedagogical role of propositional logic in critical reasoning courses is questionable at best. Teaching a formal system of logic as critical reasoning interprets a formal system through the broader natural language concepts. It then uses natural language to show the difference in meaning in the formal language, ultimately demonstrating that the formal language and natural language have different meanings. These different meanings – for example, connectives – do not correspond to natural language-usage or meaning. More so, even the evaluative concepts of the logical formal system, namely “validity” and “deductive,” are natural language explanations of logical formal language concepts. The substantive interconnection between the two cannot be denied, which leads to a further question: why teach a system of reasoning that is different in meaning and requires learning more concepts that are irrelevant, than simply focusing on natural language reasoning? In terms of conceptual economy, it is pedagogically faulty, as the formal system of logic is not necessary for understanding natural language arguments.

One final consideration should be noted with respect to natural and formal languages. Scriven (1976:141–142) articulates a problem with the translation between languages, if they are expressively equivalent, translation should work bidirectionally. In the context of propositional logic as a formal language, translating formal language into natural language makes little sense. It is only because of the original natural language that any translation into propositional language makes sense. There is a conceptual dependency of logical formal language on natural language, but not in the other direction. This unidirectional translation functions because of the limited meaning of the formal language being drawn from a much richer language, natural language. But this makes the relationship more peculiar still, due to the meanings of the connectives, the definition of “validity” and of formally deductive arguments. A particular set of ideas drawn from natural language exhibits a particular result in propositional logic, which can only say so much. With human reasoning being a complicated activity, propositional logic – as a system of reasoning in a critical reasoning course – simply cannot say enough about the practice of giving and providing reasons in everyday life.

Pedagogically, instructors should realise the conceptual extent of a logical formal language and its dependence on a natural language for intelligibility. It is their duty to present logical ideas that are practical in use, represent normal reasoning practices, and do not rely on a formal language to say something about natural language, when the formal language is not expressing the right ideas that are relevant to the practice of ordinary reasoning. An instructor who teaches the system of propositional logic as the ideal of reasoning, misunderstands the direction of intelligibility, which fails in theory and in application, leaving students’ critical reasoning education incomplete.

5.8 The possibility of deductive formal reasoning as a part of critical reasoning

So, what might the role of deductive formal reasoning be in a critical reasoning class? There are at least three uses. The first is constructive: students should have an idea of deductive validity. They would then be aware of the formal definition and its implications. If all the premises are true, the conclusion must be true and the necessary connection between the premises and conclusion for contrastive understanding is extant. Contrasting deductive validity and its necessary logical consequence relation with inference to the best explanation and conductive arguments, students can appreciate their limited logical consequence relations. A greater understanding arises, then, of the difference between formal and informal reasoning. But teaching deductive validity does not entail that students should be taught propositional logic as a system.

Walton (2006:62), for instance, uses principles of implication like *modus ponens* to express necessary deductive relationships. This can be useful as the logical form is clear and students can understand the basic idea of logical relations from their uses. *Modus ponens*, depending on how it is taught, does not necessarily need any explanation of the material conditional, and in fact, can be taken as representative of a strict or indicative conditional from English. If the previous is true, deductive implication principles such as *modus ponens* and *modus tollens* can be taught and used effectively without teaching the complete system of propositional logic, or even just the semantic side, as some critical reasoning instructors do.

An example may help with understanding why *modus tollens*, for instance, might be a good principle of implication to teach. Imagine an archaeologist is brought in to assess the natural state of a piece of property before purchase. If the property is native (undisturbed), a further legal permit will have to be applied for and granted, making the property a bad purchase. However, if the property is non-native – meaning it has already been disturbed significantly – a permit does not have to applied for and the property is a good purchase. The archaeologist surveys the property and finds that it has been disturbed.[119]

If the property is native, it has not been disturbed.
The property has been disturbed.

Thus, the property is not native.

[119] Thanks to my colleague Mark Deering for a discussion of this example from his experience as an archaeologist.

The use of *modus tollens* in this example makes the inference clear and sets the basis for a course of action, i.e. buying the property. This is one persuasive use, but it should not be assumed that the argument could not be cast otherwise without the conditional.

Another use of deductive formal reasoning is critical. Students in a critical reasoning course should understand why propositional deductive validity does not capture our normal practices of consequence drawing. If students are taught the difference in logical consequence relations, they will understand the difference between monotonic and non-monotonic relations. From there, they understand the static nature of propositional deductive validity, in contrast to arguments in ordinary language, especially arguments that are part of an inquiry.

The final use of propositional logic is character building. In one's educational experience, specific courses test one's perseverance and resolve. Propositional logic is character building, especially for those who have limited success with formal reasoning of any kind. But, to build character in this way, the system of propositional logic needs to be taught and that is something that is not justifiable given time and content constraints in a critical reasoning course. It is, however, perfect for an introduction to logic course. Rigid rules, following them to achieve results, is a model in one sense for everyday life. Critical reasoning courses that do not include some form of formal reasoning miss out on this benefit, as natural language is not as rule based nor is it as bivalent in content. So, the consequence needs consideration, but it is probably not a serious one given that students may be able to take an introduction to logic class, or increased rigour of another sort may likely be taught in a critical reasoning course.

Before concluding, one view needs discussion about teaching formal logic in general. Geach (1979:14) discusses a "master-apprentice" relationship between an instructor of logic and students. He wants to think of this as a pedigree of sorts (1979:15). One apparent justification for teaching formal logic – syllogistic and then propositional – is this passing down of knowledge and practice from teacher to student, which Geach (1979:15–16) calls a "self-perpetuating skill." Good logic teachers are exemplars for future generations of logic teachers. Even if one does not become a logic teacher, the skill continues because it was taught well. But, this type of relationship where ideas are handed down to younger generations as justification for the practice and content is misguided. It divorces the context, as many students are not philosophy majors. More so, it assumes that the prior chain of logic professors and their pedagogy was effective. Geach (1979:12–14) claims that he does not care about the certificate but the lineage of a teacher as part of a justification, at least in part, of one's competence. Of course, something is correct about that in terms of professional relationships, but in the general teacher-student context, it does not have the same relevance. There is no obvious need to self-perpetuate formal logic from a student's point of view, especially in a critical reasoning course.

Given what has been written in this chapter, the very fact that some critical reasoning instructors teach what their "masters" taught, namely propositional logic, is evidence for rejecting this "master-apprentice" view of competency and material justification. In fact, this relationship might be part of the problem where the "master" taught the unquestionable significance of propositional logic to critical reasoning practices. But if this relationship is part of the problem, it can also be part of the solution. Should new "masters" start teaching critical reasoning without propositional logic, a new "master-apprentice" relationship will develop and so will the improvement of the critical reasoning field? When critical reasoning instructors, critically reason about the role of propositional logic and its relationship to everyday inference, a new self-perpetuation will unfold. Ultimately this may manifest in students who self-perpetuate the relevant ordinary language aspects and defeasible inference of critical reasoning.

5.9 Concluding thoughts

Propositional logic has taken on a role in some critical reasoning courses that is unwarranted to a large degree. It also takes on a general role of reasoning in introduction to logic courses, where it is the standard formal reasoning practice. This chapter lays out various problems with the inclusion of propositional logic into a critical reasoning course. This chapter has also made a cautious claim that introduction to logic courses and critical reasoning courses should be different courses for the benefit of the student. The confusion between the courses comes from many directions, including textbooks that are used in both, graduate education that does not make a clear difference between the two, and confusing the role of implication versus inference. If instructors are going to take critical reasoning as its own discipline, it should stand on its own based on inference, not implication. Otherwise, if instructors are not cautious natural language argument will be held to a logical standard based on a formal logical system and its relations, which itself is a caricature of reasoning in everyday practice.

Reconsider the fifth research question, *why does propositional logic fall short as a theory of critical reasoning*? In this chapter, propositional logic was shown to be of suspect value for a critical reasoning course. There are a myriad of problems including: translation problems, formal reasoning is not a natural process (it must be taught), and a confusion of implication and inference. One particular part of propositional logic that was questionable was formal inconsistency and the logical results of ECQ and EFQ. Both ECQ and EFQ are understood as principles of inference when they are not. More so, a greater confusion manifests about argument types, monotonic v. non-monotonic. If most critical reasoning arguments are non-monotonic, then ECQ and EFQ being monotonic arguments are a category mistake in applications of inconsistency. Propositional logic falls short as a theory of reasoning and as a pedagogical choice.

A question then arises, what should be taught about inconsistency in a critical reasoning course? In chapter four, the semantic conception of inconsistency was developed as an alternative to standard formal conceptions of inconsistency. But, one cannot suppose that a new conception is valuable just because it is new; it must also be practically and theoretically worthwhile. The link between the conception and the practicality rests on how it is incorporated into the curricula and why. To go further, however, is warranted, as one must be self-reflexive and consider the worthwhileness of the incorporation into the curriculum and answer possible objections to it. Thus, the next chapter tackles incorporating the semantic conception of inconsistency into the curricula and developing a reflexive account of its strengths and weaknesses

Chapter 6: Applying the semantic conception of inconsistency to the pedagogy of critical reasoning

This chapter applies the semantic conception of inconsistency to teaching critical reasoning. There are eight subsections in this chapter with the first six using the ideas from chapter four displaying their incorporation into pedagogy. The next subsection tackles the broader philosophical issue of assertability conditions and its relation to critical reasoning. The final subsection considers a handful of present-day critical reasoning texts and critiques their pedagogical thoughts on inconsistency.

6.1 The role of natural language in critical reasoning pedagogy

It might seem odd to justify the use of natural or ordinary language in critical reasoning pedagogy. But, given the confusion between introduction to logic courses and critical reasoning courses, the justification is apt. Critical reasoning courses are not introduction to logic courses. One fundamental area of difference is between inference and implication. Critical reasoning courses should have inference as their main concept not implication. In one sense, the confusion between inference and implication is understandable. This confusion may lead to incorporating propositional or syllogistic logic into a critical reasoning course as a theory of inference. But correcting this pedagogical flaw allows students to focus on reasoning within language that they use daily.

Corcoran (1973:74) identifies no fewer than twelve different uses of "implies," which is the logical sense of implication. Three of these uses include: truth functional, logical consequence, and logical deducibility (1973 59–61). Truth functional implication follows from the truth table for the material conditional, where "α implies β" means α= 0 or β =1. Logical consequence implication, where "α implies β," is one of containment where β is already conceptually contained in α. For example, the interior angles of a triangle sum to 180 degrees implies the interior angles of a right triangle sum to 180 degrees as well. Corcoran (1973:60) adds that logical consequence implication is independent of truth-values and displays the property of logical impossibility, it is impossible for $\alpha=1$ and $\beta=0$. Logical deducibility implication, where "α implies β," is one of derivation where β follows from α through logical steps, namely transformation rules or mathematical rules. Corcoran (1973: 61) states with this sense of implication "To say that [β] is logically deducible from [α] is to say that it is theoretically possible to carry out step-by-step, in a logically correct way, a process of deduction leading from [α] to [β]." So, there are at least three main senses of "implication."

Three pedagogical points follow from the types of implication. On the first point, the second use of implication might have some carry over to natural language reasoning with conceptual containment, but the other two do not in any clear manner. But the second use is trivial and of little value to ordinary language arguments that do not have any conceptual containment. "Conceptual containment" is typically a property of deductive arguments, not other argument types normally associated with natural language reasoning. On the second point, not only are "inference" and "implication" confused, but what about types of implication? If implication *simpliciter* is that valuable for students, should not the various meanings of "implies" be taught as well? It seems that pedagogically, if one is going to teach implication through formal logic of some kind in a critical reasoning course, then the various meanings should be taught, too, for a comprehensive understanding of the term. Yet, when the various meanings of "implication" come forth, its multifaceted meanings are even plainer because they have little to do with natural language argumentation. On the third point, implication is a formal logical property that must be satisified, whether truth-values are in a unique sequence, conceptual containment, or a deducible pattern. Natural language arguments typically do not involve any orderly sequence of reasons, there are conceptual relations not containment, and outside a basic argument structure, there are no rule licensed moves to transform premises into a conclusion. Thus, natural language arguments share little with these three senses of implication, which by contrast, demonstrates their use of inference.

Natural language is also more robust, and, as a focus of reasoning, needs more time in the pedagogical queue. Formal logic is typically not as time consuming because of its reliance on understanding a handful of rules and applications. Translation can take more time to teach, however, this makes the point about natural language even from the perspective of formal logic. This translation project may even take on a life of its own for the instructor, as it may become a justification for using the formal system. But that activity is largely due to the conflict between more complex natural language sentences and the formal language. Spending this time detailing how to schematise arguments in natural language keeping their meaning and structure intact, is more productive. Improving one's linguistic skill carries over to all areas of life, not just reasoning. The practical import, is that focusing on natural language in a critical reasoning course not only benefits the student with reasoning, but also with gaining and using a diverse vocabulary.

Building on the previous idea, in a critical reasoning course, there is a finite amount of time to teach students the necessary content. If one focuses on learning a logical system and all that involves (translation, rules, solving problems, etc.), that time is lost. Instead of focusing on natural language and inference, students learn something that has limited applicability to everyday reasoning. This raises an ethical question about curriculum issues: what should be taught? Consider a typical three-unit semester course in the United States. A semester course meets 54 hours over eighteen weeks, or three hours a week. In my introduction to logic course, it takes about ten class sessions from start to finish with propositional logic moving from translations to simple WFF tables, to complex WFF tables, to truth table arguments and finally to refutations. Ten class sessions are five weeks or fifteen hours, almost a third of the course. If I were to include that logical content in my critical reasoning course, I would have to drop a paper assignment and fundamentally change the focus of the course to a bare-bones informal reasoning course harming students' learning of CR in the process.

One fundamental difference between critical reasoning and introduction to logic courses is the focus on writing. Students do not become better writers by learning and manipulating formal symbols. It is unclear if there is even a relationship between the two – writing and symbol manipulation – in practice. Students must learn to recognise the context of an argument and its formation in natural language from life examples. They can use that information to pattern their own arguments in the future. Seeing and examining natural language arguments gives students a resource to draw on for their own writing. Argumentative writing is a skill that benefits a student at every educational level, and in life.

Pedagogically, then, natural language must be the emphasis of a critical reasoning course to benefit the student through refined exposure to content, conceptual delineation, inferential improvement, persuasive argument construction, and improved reading and comprehension skills. Thus, the role of natural language is fundamental in critical reasoning pedagogy.

6.2 Antonyms and their role in inconsistency judgements

Pedagogically, antonyms are an uncomplicated way to open a discussion of inconsistency. A critical reasoning course focusing on language use and argument formation may point out how antonyms function and inform the practice of conflict detection. After a brief review of synonyms and antonyms, students can extend that understanding to reading passages and consequently schematising arguments. There is no need to avoid the antonymic conflict in schematising if the conflict is part of the argument. Typically, we are not taught to resolve antonyms, which leads to a more open-minded attitude toward the conflict and whether it is important or not.

By further emphasising the role of antonyms, students learn the non-canonical antonyms that result from adopting the conceptual model. For instance, “Jim prefers to eat meat rather than vegetables” does not contain any typical antonymic pair. However, given the context, “meat” and “vegetables” conflict. This conflict may be substantial or not, which is determinable in context. Creating exercises and assignments to recognise the non-canonical antonymic content, cues students for further conflict detection into different contexts. The RZ article’s non-canonical antonyms include “suicide” and “murder,” “hanging” and “strangulation.” By showing examples of increased subtlety and reinforcing through exercises of equal subtlety, students develop a refined technique for identifying conflict.

Relying on antonyms and semantic conflict to introduce students into a broader discussion of inconsistency, truth-value conditions and assertability conditions may build on that foundation. Truth-value conditions make little sense without understanding the conflict in the context. In fact, without understanding the context first, truth-value assessment is without warrant. Assertability conditions are a bit different and deal with the problem of the conditions that it is fitting to say something. Understanding the conflict can lead to what linguistic and pragmatic conditions hold for the assertion. In the RZ argument, there are multiple conditions of assertion: with the official suicide account; the alternative murder account; and the overall controversy of both accounts together. So, understanding the conflict can lead to further evaluation through truth conditions and/or assertability conditions.

6.3 Recognise semantic conflicts before logical conflicts

One traditional logical account (Walton 2006:44 &181) defines "inconsistency" as all claims cannot be true. Any false claim in conjunction with the other true claims would be inconsistent in truth-values. This is an example of logical conflict, where there are true and false values in a set of claims. In this type of conflict, the truth-values are the standard of evaluation, not the semantic content of the claims. Consider the following set of claims from Quine's *Web of Belief* (1978:17–18):

> "1. Abbott, Babbitt, and Cabot are the only suspects in a murder case.
> 2. Abbott has an alibi (registered in a hotel away from the murder).
> 3. Babbitt has an alibi (brother-in-law says he was with him away from the murder).
> 4. Cabot has an alibi (shown on TV)."

According to Quine, 1–4 cannot all be true (1978:18). In other words, this set of claims 1–4, is logically inconsistent, as at least one of them is false. All three suspects have alibis. An initial assessment defies the semantic conflict idea and leads one to believe that assessing truth-values leads to a resolution. However, the way the set of claims is set up leads to that conception. Let us recast that set of claims in ADM form:

R1: Abbott, Babbitt, and Cabot are the only suspects in a murder case.
R2: Abbott has an alibi (registered in a hotel away from the murder).
R3: Babbitt has an alibi (brother-in-law says he was with him away from the murder).
R4: Cabot has an alibi (shown on TV).

CQ: Who killed the person?
CC1: Abbott did.
CC2: Babbitt did.
CC3: Cabot did.
CC4: Someone else did.

R1 and CC4 conflict, Quine said that one way out of the argument is to deny the truth of R1 (1978:18). However, that assumes knowing the truth of R1. To make any headway on this argument, there is a need for the assessment of the content of R2–R4. There is an unstated idea lurking in the background that draws contrast, the murder location. This contrast with the reasons is: “registered in a hotel” conflicts with “the location of the murder;” “with the brother-in-law” conflicts with “the location of the murder:” and “shown on TV” conflicts with the “location of the murder.” So, there are three pairs of conflicting ideas.

The next step is to assess both the strongest conflict and the weakest conflict. Cabot’s alibi expresses the strongest conflict; it is rather difficult to murder someone while being on TV doing something else. Abbott’s is the next strongest conflict; a hotel register typically involves some form of official verifiable identification. Babbitt’s conflict is the weakest, unless his brother is someone whose testimony would be authoritative. The lack of strong conflict points to Babbitt as being the likely suspect, so “Babbitt did it” conflicts with R3, Babbitt’s alibi.

Pedagogically, students can be taught to semantically analyse a set of claims in the context of an argument using the ADM without knowing the truth-values of the reasons, much like what was done with the Quine argument. The same answer of “Babbitt” comes from semantic conflict analysis or truth-value analysis, whereas the former leads to the latter, the same cannot be said in reverse as there would be no basis for the truth-value determination without the semantic content.

To suppose truth-values, as Quine did (1978:17–18), misleads the actual context of an argument, as even on the propositional model, a hypothetical validity assessment precedes a soundness evaluation. The natural progression is from understanding to truth, with understanding being the only information that is available in many cases. Students benefit from instruction in semantic conflict analysis much more so than truth-value analysis given the changing world, where contexts shift and so do truth-values.

6.4 Semantic conflicts as another level of assessment and evaluation

“Valid” and “sound” are deductive argument evaluations; “weak” and “strong” are inductive argument evaluations. Deductive argument evaluations consist of a structural element, validity, and a truth functional element, soundness. Inductive argument evaluations use the plausibility of the premises and their degree of connectedness to the conclusion to evaluate the argument. In a strong inductive argument, the premises are highly plausible and their connection to conclusion is substantive. In contrast, a weak inductive argument may have premises that suffer from implausibility and/or the connection to the conclusion is questionable.

Pedagogically, “valid” might be the hardest to teach because students confuse formal structure evaluation with truth-assessment evaluation. Valid arguments do not have to make semantic sense, they just require the right structure, a necessary relationship between the premises and conclusion. Inductive arguments, when trying to teach “weak” and “strong” benefit from contrasting examples, showing how context affects the evaluation.

Students are typically taught these four evaluative concepts for two different types of arguments. But neither kind of argument has any specific assessment or evaluation for inconsistent arguments. Instead, an *ad hoc* initial assessment attempts to resolve or minimise the inconsistency before schematising the argument. A logic professor might instruct her students that it is a waste of time to form an argument with inconsistent premises. But, while that advice may be true in some cases of deductive arguments, it is not true in all arguments. So, pedagogically, there is a need to give students a way to assess those arguments for substantive and non-substantive inconsistencies.

In chapter four, a distinction was drawn between “substantive” and “non-substantive” inconsistency. “Substantive” was linked to “strongly inconsistent”; “non-substantive” was linked to “weakly inconsistent.” The major difference between “substantive” and “non-substantive” is the impact on human action. A substantive inconsistency results in paralysis of action, whereas non-substantive does not. So, the following six steps could be a guide to where a conflict exists:

1. Schematise the argument including the conflicting reasons and competing conclusions.
2. Is the inconsistency weak or strong? If “weak,” stop and continue with the argument.
3. If strong, does the inconsistency result in inaction? If “no,” continue with the argument.
4. If the answer to 3 is “yes” then consider the broader context and attempt to understand a way that action can follow.
5. Does the broader context allow for action? If “no,” stop, the argument is intractable.
6. If “yes,” use that context and move forward with the argument.

If 5 is the case, then label the argument IRINCON for “irrational inconsistency.” If 2, 3, or 6 is the case, then label the argument RATINCON for “rational inconsistency.”

By labelling in this way, the inconsistency is acknowledged and further action may be warranted. The acknowledgement of inconsistency saves one from the typical *halting* criticism where someone points out the inconsistency and uses that to end the conversation.[120] This halting effect of inconsistency is unfortunate and is common. But, what the halting effect displays is someone being unreflective on inconsistency and pedagogically. Students need to be warned that a halting response is not the appropriate response without critical reflexion on the inconsistency. Using the six steps necessitates that someone is reflective on the inconsistency.

The six steps give a general progression for sorting out substantive inconsistencies from non-substantive inconsistencies. The notion of “action” is a bit vague but that is acceptable because the paralysis aspect contrasts with it, namely, someone no longer knows what to do with the argument. The following is a more robust articulation of a way to sort them out in more difficult cases, which could follow this progression:

1a. Schematise the argument for the conflicting reasons and competing conclusions.
2a. Determine which reason is relevant to which conclusion.
3a. If a conflicting reason is not relevant to at least one conclusion, then either consider adding a conclusion that it would be relevant to or get rid of the reason.
4a. Do the relevance articulations for all the reasons.
5a. Determine which conclusion is the best conclusion, if possible. If two or more conclusions are equally ranked as the best, the argument is RATINCON: for rational inconsistency. If there is a single conclusion at the top of the rankings, the argument is SINCON: for single conclusion.

RATINCON and SINCON are different in conception and application. RATINCON admits the inconsistency has not been resolved in terms of argument

[120] This seems to occur more often when someone has been taught that “inconsistency” is a fallacy, and with those who have received instruction in rhetoric and persuasion.

as the conclusions are still manifesting the inconsistency. SINCON indicates the inconsistency has been resolved to some degree as the argument supports a single conclusion. So, RATINCON can function in two ways. First, it works as a general label that the argument contains an inconsistency that necessitates some action is needed (probably more reasons to strengthen a particular conclusion). Second, it functions as a contrast to SINCON, which is a further evaluative idea with stronger action associated with it being a single conclusion. SINCON provides more grounding for belief in a single conclusion than with the competing conclusions RATINCON.

A straightforward way to demonstrate these concepts is to consider a criminal investigation where there is justification to believe a single suspect committed the crime versus two suspects, supposing it is a one suspect crime. Yes, in the two-suspect ranking, at least it has been narrowed down to two (RATINCON), but there is still no definitive belief in the one suspect that did the crime (SINCON). More evidence may justify a single suspect (SINCON).

Pedagogically, both progressions can be used and should be taught allowing students to properly assess and evaluate arguments with inconsistent reasons. In the context of teaching the ADM, to incorporate this content is easy and takes minimal time. While some may worry that this becomes overly technical, it provides a decision procedure for inconsistent arguments, which typical critical reasoning pedagogy has remained silent on. Students will encounter inconsistent arguments in their lives, so critical reasoning pedagogy demands this type of content inclusion in the curriculum.

6.5 Rethinking informal fallacies

For some critical reasoning courses, fallacies form most of the content. The influence of Hamblin’s (1970) seminal work on fallacies manifests this approach. Historically, Hamblin’s work is the first detailed contemporary work on fallacies and thus may be part, if not the impetus, of the informal logic movement (Groarke 2011:§1). Students who inherit this fallacy priority are taught to be fallacy detectors to make them more effective reasoners. More so, it is common in

English composition and rhetoric courses to spend time on informal fallacies to improve one's writing and speaking.[121] This approach may benefit students if they are prone to writing and arguing fallaciously, and are taught the correct application of the labels.

In my estimation, fallacies are over taught and take on an unwarranted significance. Reviewing textbooks – Moore and Parker (2015) and Engel (1999), for instance – most fallacy examples are contrived and not from actual sources. Even when actual sources are used, students may or may not understand the greater context, which can affect the application of the fallacy label. Yes, fallacies do occur, but it takes more skill to figure them out in many cases, a skill most students do not have or it is not sufficiently developed yet. But with a false confidence, they may believe they do resulting from a superficial pedagogical approach in English and Speech courses. Students learn some labels and apply them to the generated instances in abstraction. For instance, from an English composition 1 source:

> "Poisoning the well: undermining an opponent's credibility before he or she gets a chance to speak. *Example: "The prosecution is going to bring up a series of so-called experts who are getting a lot of money to testify here today."* (Lumen 2018)

Note the italicised portion of the example. Without an understanding of the greater context, it is not clear that this claim is a fallacy. If they are professional witnesses, they are getting paid to testify. If their professional expertise is limited, they may be "so-called" experts. The way the fallacy is defined, attacking someone's credibility before one speaks is not necessarily a fallacy if you have prior knowledge of the person and their background. The supposition here is that in order not to commit the fallacy, someone should listen to the person regardless of their background, but in this context of a courtroom and professional witnesses no one would take that seriously.

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[121] For instance, at Rio Hondo College fallacies are covered in ENGL 101—College Composition and Research; ENGL 201—Advanced Composition and Critical Thinking; SPCH 101—Public Speaking; SPCH 140—Argumentation and Debate, and SPCH 240—Argumentation and Discussion. http://riohondo.curricunet.com

Imagine in this case, the defence attorney knows the professional witnesses and the claim is accurate, they are getting paid a lot of money and they are not experts in the area. The supposition for the fallacy is that the claim the defence attorney is making is inaccurate and that looks dangerously close to another fallacy, begging the question—assuming what needs to be proven. Or, if the prosecutors know that the professional witnesses are “so-called” experts, have they not poisoned the well against the defence attorney’s claim by questioning it? The point of all of this is that simply labelling fallacies outside of their context is not a skill we should want our students to develop. They may not understand the contextual subtlety of accurately labelling fallacies. The pedagogical result is a practical confusion and avoidable.

One significant problem with the fallacy labelling approach is that it is potentially disruptive to argumentation. Built into this approach is a destructive aspect that is rarely addressed. In a dialogue where someone thinks there is a fallacy and charges the other person with that fallacy, the argument stops. It assumes both sides are competent and understand the fallacy. It may very well be the person being charged with reasoning fallaciously has no knowledge of the fallacy label. But, if the problem were articulated, an understanding might be possible. Fallacy labelling introduces an elitism into reasoning, creating an unnecessary disparity between two or more parties.

Pedagogically, this fallacy elitism can be highlighted by asking the person to explain the fallacy and to then explain how the fallacy applies in this situation. Not surprisingly, explanations are thin because one’s understanding is extremely limited to the examples used in class. But it does not end there. When using fallacy labels in an argument, someone, the opposition, may be too embarrassed to ask what they mean. Fallacy labelling then halts the argument with someone appearing as if they have successfully reasoned, when the real situation is more complicated. Students must be taught to set their egos aside when engaging in honest inquiry.

Instead of stressing learning various fallacy labels, the ADM proffers a way to talk about bad arguments. Simply, the relevance articulations show reasons and their relationships to conclusions. In this relationship analysis, reasons that lack connections or have suspicious connections, are excluded from the argument. No labels are needed just a basic understanding of relevance. This requires a change in pedagogy and reorientation away from the unwarranted significance that fallacies play in the critical reasoning curriculum.

This is not to say, however, that all fallacy education should be avoided. Instead, a pedagogical approach that emphasises the context of fallacies and a few common ones that students are more likely to experience should be put forth. These fallacies could be tailored to specific disciplines, for example the *ad hominem* to communication students, or causal fallacies, like the questionable cause, to social science students. An unreflective approach to fallacy education is not the best choice for students to get something out of their fallacy education.

To further explain how semantic inconsistency is a relevant topic to fallacies, a selection of fallacies is now shown to have a semantically inconsistent element in them. The context, however, settles the value of the inconsistency and then by extension, the value of the fallacy. Other fallacies could be used, so this list of fallacies is not exhaustive.

6.5.1 *Tu quoque*

The *tu quoque fallacy* depends on recognising the inconsistency between what someone says and what someone does. So, there is an inconsistency between belief and action. In ordinary terminology, the person is a “hypocrite.” The problem with this fallacy is that particular contexts justify the inconsistency and it is not a fallacy. The attack on the person is thus minimised in favour of what is being said. For example, if a drug addict tells someone not to use drugs, but is still a user, there is an inconsistency in belief and behaviour. An uninformed conception would charge the person with a fallacy because the person is still an addict and not following his own suggestion. However, rationality tells us that with addiction, the person speaking is an authority on the matter, yet does not have the power to stop the behaviour and desires. Who is better to speak about it? None, the addict has the floor. So, the attack on the person, or fallacy, is negated through recognising the value of the person's testimony in context.

6.5.2 False analogy

An analogy is the idea that if something is alike in one respect, it should be alike in another respect. Men are like women in terms of need, so, as men need food, so do women. The false analogy fallacy works on the idea that instead of things being alike, they are different. This fallacy brings out a natural tension between "alike" and "different", a conceptual antonymic conflict. For instance, education is like business, so just as business is about profit, so education is about profit too.

The false analogy fallacy rests on recognising that two things are not alike in some sense. To the degree they are dissimilar, the stronger the fallacy. However, are all analogies that are dissimilar, fallacious? Probably so because the unique nature of an analogy works on similarity and if there are substantive differences, something has gone wrong. So, with this fallacy, the inconsistency undermines the very nature of the argument type.

6.5.3 Hasty generalisation

The hasty generalisation fallacy occurs when from a limited sample size, an unsupported general claim is inferred. The inconsistency is between the specific claim and the general claim. For instance, on a television news show a claim may be made: "An attack on Hillary Clinton is an attack on all women." The women on the subsequent panel discussion could state that it was not true and an attack on Hillary Clinton is just that, an attack on her.

But this fallacy, can be questioned with the following kind of claim "a rotten apple made me sick, so all rotten apples will make me sick." Of course, someone may not get sick, but with different content the fallacy does not look as obvious. Consider a stronger claim, "Socrates ate a lot of hemlock and died, so anyone who eats a lot of hemlock will die." This version does not appear to be fallacious at all. The definition of “unsupported general claim” may be invoked that the “rotten apple” and “hemlock” are supported through empirical science. True, but the basic idea of the relationship between a limited claim and a specific claim is being challenged. Do we know that everyone who eats a substantive amount of hemlock will die? Science would demonstrate that such people would die and it is a reasonable inference.

Pedagogically, pointing out the relevance of the extension from limited to the general, allows assessment of the potential flaw. The Hillary Clinton case is a clear fallacy. The rotten apple situation is not a clear fallacy, nor is the hemlock instance. Someone’s motivation for this fallacy might be incompetence or insincerity. Students should think about the broader context, and if someone is incompetent, discuss why it is a problem. Insincerity does not deserve the same pedagogical respect because understanding is already in place before the deception.

6.5.4 Quibbling

The fallacy of quibbling is interesting because it involves distraction, that is a conscious agent’s detraction from the main issue by focusing on a minor one. The inference is that since the minor issue is undermined, so is the main issue. The inconsistency is between the significance or relevance of the minor issue and the main issue. In the RZ case, quibbling occurs if someone were to argue that since the damage to the neck cannot be settled, it still must be a suicide. The main issue is that there is evidence for murder and focusing on the neck alone undermines and is inconsistent with that key evidence.

Pedagogically, quibbling is easy to address. Students do not take the fallacy route but instead ask, “which issue do you want to focus on, the neck or the suicide/murder?” Students must be taught to be actively engaged and critically reflective of the dialogic process. They might also ask, “what is the motivation for this?” Does the person not know any better or is the person trying to distract me on purpose? While the suggested response of not taking the fallacy route holds in both cases, understanding one's motivation may make more sense of how the rest of the argument may go.

6.5.5 Suppressed evidence

The fallacy of suppressed evidence occurs when someone does not include all the relevant evidence to an argument. Typically, someone withholds evidence that discounts or harms the plausibility of a particular conclusion. The inconsistency is between two arguments: the defective schematised argument and the robust schematised argument. In the RZ case, had the height of the "She saved him …" message not been schematised, evidence would have been suppressed relevant to the murder conclusion.

Pedagogically, this fallacy poses an interesting problem. Schematisation issues are not semantic issues like the previous fallacies. Was the evidence left out on purpose or was it done through incompetency? A different assessment is needed to determine why someone did this. If it is incompetence, it is not clear it is a fallacy. But if it is insincerity, it is a fallacy due to the purposive behaviour. Students should be taught that incompetency is the default position, as it allows one a graceful exit from the argument or the ability to include the relevant information.

6.5.6 Concluding thoughts about fallacies and inconsistency

A survey of a handful of fallacies reveals that they contain semantic inconsistencies. Sometimes these inconsistencies can be resolved, other times they cannot. The motivation for a fallacy also needs to be part of the fallacy assessment, and students should be taught that the motivation sets a broader context for understanding the argument and what direction it may go next. Fallacies and arguments in general are commonly based around the truth of claims being made. However, in critical reasoning, the truth of claims is not often known, so we now turn to understanding how claims can be thought of without truth conditions.

6.6 Understanding assertability conditions as non-truth functional

Throughout this thesis, the importance of truth conditions for critical reasoning has been downplayed. Truth conditions are more a function of formal logical systems. They perform a particular role in that system, especially with truth tables. With no formal evidence for the following claim, it is likely the case that propositional logic's truth tables and truth-values were co-opted for generalised reasoning. Students, through an emphasis on truth tables, were taught that arguments were no longer about the reasons themselves, but about truth and falsity.[122] The problem, with respect to natural language arguments, is that truth-values of reasons may be unknown. This problem of truth-values runs even deeper because any discussion of inconsistency is commonly done with truth-values. Thus, one may argue that truth-values and truth conditions have deeply infected the practice and pedagogy of critical reasoning.

What might be an alternative to truth-values? In the following paragraphs, the concept of "warranted assertability" is developed in combination with having good reasons. This combination comports to some degree with our natural practice of considering reasons as good reasons regardless of their known truth-values. Gilbert Harman's work is seminal with respect to reasoning in this sense, so a discussion of it follows.

Harman (1986:46) defines the "principle of conservativism" as "One is justified in continuing fully to accept something in the absence of a special reason not to." For Harman (1986:47), fully accepting something means that the inquiry has ceased and the only way to reopen it is with a substantive reason to the contrary. But it is important to understand the crucial distinction for Harman between (1986:46) "full beliefs" and a "working hypothesis," he writes:

> "This is not to say there is a sharp line between full beliefs and working hypotheses. One's acceptance of a working hypothesis can gradually become more than tentative, so that eventually one is no longer investigating that

[122] In the pedagogy of using truth tables, students learn that a truth table is a logical diagram demonstrating all the possible truth value combinations for a WFF, and then by extension to multiple WFFs in an argument. Because the translation into symbolic language is the first step, the semantics of the sentences turned into WFFs is downplayed in favour of truth conditions.

> hypothesis but has fully accepted it. Things can go the other way, too. If "anomalies" arise with respect to a view, one can pass from fully accepting it to accepting it more tentatively and merely as a working hypothesis."

This short paragraph shows the nature of inquiry, which is two-directional varying on relevant information. A hypothesis can move from the tentative stage to being fully accepted. Should a conflict arise with a fully accepted belief, it can move in the other direction to a working hypothesis. The RZ argument started out as an argument for suicide with some fully accepting that conclusion. However, the additional information provided in the new article conflicts with the prior information moving the fully accepted belief to a working hypothesis.

To make Harman's thoughts particularly relevant to this thesis and the concept of "warranted assertability," consider a rearticulation of the principle of conservatism into two separate principles, strong and weak. Let us call Harman's principle of conservatism, "strong conservatism." In contrast, let us define "weak conservatism" as "one is justified in continuing to *provisionally* accept something in the absence of a relevant reason not to." In this sense, weak can move to strong and strong can move to weak in relation to conflicting or additional evidentiary reasons.

"Warranted assertability" found its earliest articulation in Dewey (1941:169–170). The general idea of warranted assertability is that the reasons provided in a context of inquiry provide sufficient support to believe something (Dewey 1941:172). One strong feature of this view is that reasons are contextually motivated and situated in time. So, a claim can be asserted with warrant at time "t" but with further information, not asserted later at time "y" with warrant. To this end, truth or proof is not part of the process or concept, as both are normally atemporal.

Imagine the following scenario. You are at the airport on your way home from a long trip. You look up your flight on the monitor and it is flashing "Delayed." What do you believe in terms of conservatism, weak or strong? Pragmatically, you act on this information because it is important you want to get home. Without consulting a broader context, it is unlikely a decision between "weak" and "strong" is obvious. Consider two different contexts around the delay. You fly often on this airline and it is regularly delayed. Strong conservativism might be in order in this context. There is no compelling reason to not believe the monitor. In contrast, suppose you have never flown on this airline and there are no other fights on delay *per* the monitor. Weak conservatism might be in order in this context, as the need to investigate further is reasonable, as you do not want to miss your flight.

A reasonable assessment of the RZ argument would be that someone is weakly conservative in believing it reaches a plausible conclusion. There are reasons to believe each conclusion, but those reasons conflict with each other. As time goes on, more evidence might move someone to believe in a strongly conservative way, where the inquiry has ended. In both instances, however, there is warranted assertability given the content and connection of the reasons to their relevant conclusions.

Before moving on to the next section, it is important to limit the scope of warranted assertability, as it is can be abused. In contemporary times, many conspiracy theories exist. The concept of "warranted assertability" is ripe for abuse by this group, as an argument can appear reasonable when it is not: the "special reason" qualification counts against the argument. Arguments can cohere and make sense as a story of sorts in that this coherence lends itself to perceived plausibility. However, introducing a "special reason" damages this coherence, usually fatally. The John Fitzgerald Kennedy (JFK) assassination is fodder for conspiracy theorists. One famous theory is the "magic bullet theory," where the bullet that was shot from the rear would have had to turn in mid-air to hit Texas governor John Connally in the front seat. This theory has been repeated *ad nauseam*, so much so, that many in the public believe it.[123] The inference from the "magic bullet theory", normally made is that since a bullet cannot turn in mid-air, a second gun shooting another bullet must have done the additional damage. So, there were at least two people shooting JFK and there is a great conspiracy not just involving Lee Harvey Oswald.

[123] In 2013, a Gallup poll (Swift 2013) demonstrated that over 60% of all Americans believe there were two shooters, and not just Oswald alone. http://news.gallup.com/poll/165893/majority-believe-jfk-killed-conspiracy.aspx

The special reason that destroys the "magic bullet theory" is simple: the "magic bullet theory" supposes that Connally was sitting directly in front of Kennedy. However, carefully viewing the Zapruder film shows he was not. Connally was sitting offset to the left. When that seating location is incorporated into understanding the events of the day, a single bullet that hit Kennedy could have hit Connally given the angle—in fact, it lines up directly. Bullets do over penetrate, leaving one body and hitting another. One special reason, namely the offset seating arrangement, destroys the warranted assertability of the "magic bullet theory." No further inquiry is needed at least with this theory as the seating position defeats the theory.

In fairness, and not to overstate the importance of the special reason here, it defeats the "magic bullet theory" but it does not defeat the idea of a second shooter involved with the assassination. To defeat that idea, something like a bullet(s) analysis showing rifling marks would indicate there was only a single gun, would work. Thus, the scope of the special reason must be specific and carry argumentative weight.

Pedagogically, teaching students the difference between assertability conditions and truth conditions is fundamental to understanding inquiry. With the right reasons, an argument shuts off further inquiry unless a defeating reason comes along, which then may or may not require additional inquiry. By delineating two types of conservatism, students learn about arguments in a way that does not necessarily have a truth determination for the premises. Students learn the concept of a reason and the role of conflicting reasons to an argument's assertability. This is a natural process for most but needs some articulation tools to make it manifestly robust. While it may not be a popular view, and it is clearly the dream of philosophers, truth does not always motivate someone.

6.7 Inconsistencies in critical reasoning texts: critical reflexions

Over the last forty years, critical thinking textbooks bloomed in numbers of available texts. Not only are there a substantial number of texts, there are numerous editions of many texts showing the marketing and economic aspect to the field. With multiple sections of critical thinking or critical reasoning being offered on many college campuses, instructor textbook choice impacts teaching. Reviewing textbooks and their content on inconsistency shows a lack of diversity of their thought. Very few textbooks offer anything novel on inconsistency and in general, support the common conception of inconsistency being about truth-values. The texts chosen to critique represent the main ways inconsistency is thought about and ultimately, if the textbook is the guide, how it is taught to students.

This section begins with a critical analysis of inconsistency in the selected textbooks. This analysis raises a few questions. Why was the concept included? What conception of inconsistency is put forth? What are the critical problems with the conception offered? The first question can be answered now. The concept of inconsistency is a standard topic due to its ability to create problems with reasoning. It is part of the typical concepts covered. But the other two questions, need specific articulation considering each authors' basis for inclusion.

To this end the textbooks speak for themselves, and a critique follows. The critique is two-fold: an analysis of the content itself and a breakdown of the impact of the content on students' learning about inconsistency. Taken dialectically, following each critique is a critical reflexion from the perspective of this thesis and its position on semantic inconsistency. These dialectic interplays of how the concepts of the thesis hold up to scrutiny in the face of competing theories may stand for at least part of the justification for adopting the semantic inconsistency theory from chapter four.

6.7.1 Moore and Parker

Moore and Parker's (2015), *Critical Thinking*, is in its 11th edition. This text is very popular in the United States, some twenty years after first publication, it continues to be a standard text in the field. This wide-ranging text brings elements of rhetoric, fallacies, and formal logic together.

The authors' (2015:230) section on fallacies, discusses the difference between "contradictories" and "contraries." They write:

> "Here is how contraries and contradictories can be confused.
> Visitor: I understand that all fish in this pond are carp.
> Curator: No, quite the opposite, in fact.
> Visitor: What? No carp?
>
> The visitor's conclusion does not follow. "None are carp" is not the opposite of "All are carp." A pair of claims that are exact opposites of each other are contradictories, meaning they never have the same truth-value. But two claims that cannot both be true but can both be false are not exact opposites: they are contraries. "None are carp" and "All are carp" are contraries, not contradictories."

Understanding "opposite" here demonstrates the semantic conflict between "all" and "no," not a logical conflict. The antonymic contrast is obvious and the visitor's conclusion is reasonable. The semantic contrast, however, does not noticeably manifest in truth-value differences to the uninitiated in syllogistic logic. The Curator's response is contrived, unless it was Aristotle, as a normal locution would have been, "No, some are goldfish." Furthermore, a real-world example of this from an article would have been helpful to justify that this kind of conversation takes place, not just simply in critical thinking and reasoning textbooks. The logical point stands as correct given the supposition of classical logical categories in syllogistic logic.

The authors continue with a discussion of consistency and inconsistency (2015:232):

> "A group of statements is said to be consistent, if, and only if, it is possible that each and everyone of them is true at the same time. A group of statements is inconsistent if it is not possible for all of them to be true at the same time. (Given what was said in the last section we could also say that a group of beliefs is inconsistent if it contains beliefs that imply contraries or contradictories.)"

The definitions of "consistent" and "inconsistent" are problematic. The notion of "possible" is wide-ranging and further adds to the confusion. Logically there are impossible worlds and possible worlds. In that sense, all sorts of statements in our physical world could be false but logically true in possible or impossible worlds. In short, this implies the thesis that all statements are true, or what is known as “trivialism” (Priest 2006:56–71). So, all statements would be consistent if trivialism is true.

In the RZ argument, maybe she did commit suicide *and* was murdered, they strangled her at the same time she was hanging, so a dual cause of death while not likely, is possible. More so, the note “She saved him…” could have been written by both while he held her arm extended and they both went through constructing the letters. These events are logically possible, but they are not plausible given our ordinary understanding of the event. Moore and Parker’s definitions lead to obvious problems like these that would be rejected in ordinary reasoning contexts.

“Consistency” and “inconsistency” are not about possibility in critical reasoning. The authors are constructing a hypothetical test for each concept, much like the concept of validity. In my estimation, any logical judgement of consistency or inconsistency only deals with known truth-values, not possible ones.

Moore and Parker (2015:232) conclude their thoughts on inconsistency with the statement:

> “An inconsistent position cannot of course be accepted, but the position of an inconsistent person may well be, depending on its merits.”

This fitting distinction between a position and a person and the distinction is right. Humans may be inconsistent in life, but that does not necessarily undermine the value of our position. However, the initial claim that an inconsistent position cannot be accepted is not true: quantum mechanics (Gibbins 1987:7), naïve set theory (Woods 2003:8), and natural language (Woods 2003:10), as examples, all contain inconsistencies, and they are not only accepted but are profitable in use. It is this kind of overstatement that undermines legitimate discussion and refined improvement of “inconsistency.” In fallacy terminology, it is poisoning the well about future thoughts on inconsistency.

Considering Moore and Parker's thoughts on inconsistency, some general pedagogical issues arise. It is possible that students may end up confused about what "opposite" means in a normal context. This confusion is further motivated by the conflict between ordinary understanding of terms and their logical construction in syllogistic logic. Introducing a possibility element into the definitions "consistency" and "inconsistency" confuses students about the concepts, whether they are actual or hypothetical. The authors overstate that inconsistent positions cannot be accepted, in fact, we have good reasons – and it is rational -- to accept some, including our science and mathematics. Critical thinking textbook authors should reflect critically on all concepts taught to ensure students learn more than the standard interpretation of inconsistency and its hyperbole.

6.7.1.1 Critical reflexion on Moore and Parker

There are a few substantive differences between the semantic conception of inconsistency (SCI) and the views of Moore and Parker. SCI does not use the concept of possibility when assessing consistency or inconsistency. SCI uses plausibility judgement which is related to actual states of affairs. Consistency is about harmony and agreement among ideas, not truth-values for the SCI. Harmony, agreement and assertability comport with critical reasoning and its practical application being ingrained in changing lives. Truth is not always known but reasoning can still be informative and effective. In cases where the truth of a claim is known, the initial objection is not as strong due to the prior settling of the issue. Nevertheless, the contrast between a plausibility judgement and a possibility judgement demonstrates a connection to reality in the former but not necessarily in the latter. If reasoning about abstract situations is desired, and truth-values are known, there may be a case for Moore and Parker's use of the terms. The question would then be, how often does this situation occur in critical reasoning contexts versus introduction to logic contexts? Its occurrence would be more likely in the latter and not in the former, making a case for its use in introduction to logic courses not in critical reasoning courses.

Moore and Parker also use the classic Aristotelian categories – contrary and contradictory – to underlie their explanation in the carp example presented above (2015:230). This focus on truth-values as the primary explanation for why the claims are different, contrasts with the ordinary understanding of "opposite." The words "all" and "none" are opposites semantically. The priority of truth-values over semantic conflict may be largely due to logical history, but that is something that needs to be argued for, not simply taken for granted. The same criticism could be levelled at the SCI. However, the intuition supports them being semantically opposite versus a second level move to make them contraries based on truth-values. Which is more natural and productive? Which aligns with critical reasoning's posits of natural language priority? An argument from what we do normally carries little weight unless it is effective. Our normal everyday reasoning practices are functional and result-producing. So, there is no obvious justification for adopting a two-step assessment model of semantics then truth-values, with truth-values taken as a priority.

The final specific area of contention is that Moore and Parker do not have a detailed mechanism to resolve or handle inconsistencies. The general tone seems to be to avoid inconsistencies if one can and resolve them before an argument is schematised.[124] The SCI has the concepts of SINCON and RATINCON nested into an argument model to enable resolution or action with inconsistencies. The argument model is effectively based on questions and answers, and using inquiry to generate reasons and conclusions. Whether this is the best argument model for doing this remains to be seen. But it is a move in the right direction, as it seeks resolution in a way that does not end in reasoning paralysis.

6.7.2 Walton

In his *Fundamentals of Argumentation* (2006), Walton lays out his basic thoughts on argument and related concepts for the masses. Walton takes inconsistency seriously (2006:44–45).

[124] Moore and Parker (2015:231) use the concept of inconsistency in a dialogical form and the "flip-flopping" is what someone assesses for believability based on its overall merit. This is consistent with the idea a person may be inconsistent. But it looks more like an *ad hominem* than a direct inconsistency problem.

Walton (2006:44) defines “inconsistency” by noting that “Two statements are inconsistent if it’s not logically possible for both to be true. By ‘inconsistent’ we mean logically inconsistent and not just practically or physically inconsistent.” Walton corrects the error of Moore and Parker by limiting the type of inconsistency to a logical one. In the context of a truth table, which is a logical diagram of all possible truth-value combinations, Walton’s view makes sense. However, the definition – as it is worded – is questionable in the following sense: two statements are inconsistent if they cannot possibly be true. But can two statements be inconsistent if they are both false? The basis for the question is semantic inconsistency. In the RZ argument “murder” and “suicide” are antonymic. Supposing the investigation went another direction and she died of natural causes, both original conclusions would be false. One might argue this third conclusion is implausible, but this is not a practical inconsistency. There is no logical necessity in either one of them being true. The point is that it not clear that his definition of “inconsistency” fits with semantic inconsistency in the argument. And, this is a general problem of defining “inconsistency” in terms of truth-values and not, at least in some degree, in terms of semantic conflict.

Walton (2006:46) reiterates his thoughts on inconsistency in the context of what someone should respond when encountering inconsistency:

> “Although inconsistency can in many cases be understood and can be resolved, in general it is something that has to be addressed in argumentation once it has been discovered. The reason, once again, is that when you have an inconsistent set of statements, not all of them can be true.”

To Walton’s benefit, he does not immediately discard the inconsistency as unintelligible. The advice he gives is appropriate: that inconsistencies should be resolved, when they can be. This thesis has proffered many thoughts on when they cannot, so its scope extends beyond what Walton has in mind. However, the last sentence of the quote is of particular importance: Walton uses another definition of “inconsistency” (2006:46). The qualifier of “possibly” is left out, and there is no hypothetical “if” (2006:46). This is a different definition and has a different meaning. Walton, himself, is thus inconsistent in what “inconsistency” means. The difference is substantive because truth-values are assumed in the latter definition and are not in the former (2006:46). There is nothing hypothetical about the second formulation, whereas the first formulation is hypothetical.

Later, Walton's view of "inconsistency" seems to confuse a few concepts, he writes:

> "As shown... inconsistency is generally a bad thing in logic. If a set of statements is inconsistent, they cannot all be true. At least one must be false. Thus if an arguer tries to maintain a set of commitments that is inconsistent, it means that there is something not right in her position. Thus the other party can use such a finding of inconsistency as a criticism" (2006:181).

Taking this quote at face value, it shows a conceptual confusion. "Inconsistency" is neither good nor bad in logic. Any normative evaluation of it is extrasystematic. His definition of "inconsistency" in this context of logic is fine and correct with the hypothetical. Yet, he then shifts from logic to argumentation about "… maintaining a set of commitments that is inconsistent …" I suspect we all maintain commitments that are inconsistent, some knowingly. Walton even admits this:

> "Also, in realistic everyday argumentation, it can be quite hard or even impossible to keep an exact record of all an arguer's commitments she incurred in the past. Thus, as a matter of general policy, commitment sets do not always have to be consistent "(2006:182).

Walton's practical intuition is right, but his method is wrong. Relying on standard logical appraisal to make sense of inconsistency competes with the practical point made later. In an ideal circumstance, yes, something is not right in her position. However, human lives are not ideal and this is another conceptual carryover from the austere nature of formal logical evaluation. The purity and clarity of formal logic blinds many to practical reality but they rarely question the disconnect between the two.

One final quote by Walton (2006:126) demonstrates his understanding of practical inconsistency. In the discussion of a circumstantial *ad hominem*, or *tu quoque*, he says:

> "Once the practical inconsistency is identified that is the focus of the attack, could it be resolved or explained by further dialogue, thus preserving the consistency of

> the arguer's commitments in the dialogue or showing that *a*'s inconsistent commitment does not support the claim that *a* lacks credibility?" (2006:126).

Walton's understanding is correct. The context and additional information can either resolve or explain someone's inconsistency. In this sense, the inconsistency does not completely undermine the point being made, it just needs to be handled in a specific way. It is unfortunate that Walton's views on logical inconsistency are supposed to relate to a productive understanding of practical inconsistency.

Pedagogically, a student using this text may question the various definitions of "inconsistency" and wonder about the relationship of the logical definitions with the concept of practical inconsistency. The instructor would have to make sense of that for the student in a critical reasoning course, which may or may not be productive. In a previous chapter, the value of hypotheticals in critical reasoning was challenged. Walton's definitions play into this use. Instead of hypotheticals and trying to assess truth-values in critical reasoning, a much better approach is warranted assertability, where students consider reasons and their value in contexts wherein truth-values may or may not be known. Walton's general approach to analysing consistency and inconsistency in terms of truth-values, sets aside the students' common linguistic knowledge of semantic conflict, the source of practical inconsistency and even logical inconsistency, in some cases. A mixed approach is more likely to confuse students than enable understanding. Here, students need to understand two concepts versus one, and depending on how it is presented, the distinction may be too subtle or unclear. Many critical reasoning instructors forget what it is like to be a student studying this material for the first time. After teaching the material numerous times, due to familiarity, it is all very clear to the instructor, but not the students learning for the first time. Scholars like Walton and others (Wright 2001 & Dauer 1989) in my estimation, are guilty of this lack of educational empathy, except in rare cases where students are exceptionally well prepared.

6.7.2.1 Critical reflexion on Walton

As with Moore and Parker, there are some areas of contention. However, in his case, a different tactic will be chosen. The idea of “educational empathy” should be considered with any textbook choice and resulting pedagogy. I remember when I was a teaching assistant for a critical reasoning course. The professor presented the material at a graduate level at times but it was rarely at a lower division undergraduate level. The fine-grained distinctions and the textbook chosen undermined the overall intelligibility in the course as evidence by students filling my office hours. I remember talking to other teaching assistants who said, “It is all so clear to him…but not to anyone else.” Whether that was a fair statement, I do not know. But what I do know is that there was little educational empathy for his students.

Walton’s work strikes me in that way. It is written at a technical level that many undergraduates would have difficulty with, including his discussion of inconsistency and related concepts, some of which are noted above. There is so much material to unpack in what he is doing with inconsistency let alone argument formation. In contrast, teaching the ADM—analytical defeasible model of reasoning with questions and answers – and the SIC are relatively straightforward. Using questions and answers, inconsistent reasons and inconsistent conclusions are obvious due to conflicting semantic content. There are no possibility judgements, no necessary knowledge of truth-values, and students do not have to sift through a few different definitions of “inconsistency,” trying to figure out which one is right in the context.

The objection from Walton’s side may be that students deserve detailed explanations, fine-grained distinctions, and an emphasis on truth. And, in principle I agree in an ideal world. Walton clearly understands inconsistency is of different forms and many issues surrounding it, as noted above. However, he does not take as seriously as he should the semantics involved with inconsistency and how that is prior to truth condition evaluation.

Pedagogically, students should be met where they are, and many must be brought up to a standard level. Given the rest of his text is similar in feel, time will be spent in other areas to ensure students have the basics, and inconsistency may not even be addressed except in passing. Complicated texts manifest in pedagogical choices being made and not all are made with student empathy in mind.

One final objection from Walton might be that I have made too much of student empathy and that his text is friendly to students. In response, I would ask “which students?” If his book is a textbook for lower division undergraduate students, as Govier, and Moore and Parker are, relatively it does not impart the same sense of an introductory text. If Walton’s book is primarily a theory book and written for advanced undergraduates and graduate students, it is a better fit. There is an important distinction to be made: there is a difference between a book about arguments and a book that teaches argument skills. It seems Walton’s book emphasises the latter over the former; whereas, my work emphasises the former over the latter. Which is correct? It depends on the audience.

6.7.3 Govier

Govier’s *A Practical Study of Argument* (2009) is a comprehensive critical reasoning textbook. It is unique because of her discussion of conducive arguments, which do not fit the typical inductive and deductive models of reasoning (Govier 2009:353–373). Govier’s thoughts on inconsistency are a bit different, she (2009:146) defines “inconsistency” as:

> “Two statements are inconsistent with each other if, putting them together, we would arrive at a contradiction. A single statement is also inconsistent if it entails a contradiction. Such a statement is not acceptable because we know *a priori* that it is false. Explicit inconsistency occurs when the contradiction is apparent on the surface, in the way the statements are worded. Implicit inconsistency occurs when the meaning of the statements allows us to infer, by valid deduction, a further statement that is a contradiction.”

Govier starts with inconsistency being an issue of logical form, that is, of two conflicting statements brought together (with a conjunction). She then shifts to a truth functional account, such that the false entails the false. She ends with delineating two different types of inconsistency, explicit and implicit. ”Explicit inconsistency” comes from a particular grammatical form, to cite her example (2009:132): “... if one premise asserts, ‘All men are emotionally tough,’ and another asserts, ‘Some men are emotionally vulnerable,’ the argument has premises that explicitly contradict each other.” “Implicit inconsistency” is semantically based and involves inference through valid deduction, as her example demonstrates (2009:133):

> “Her death was due to a traffic accident, an accident that can’t have been anyone’s fault. The stop sign was not clear because of snow piled up near the corner, and the streets were slippery. To make matters worse, the young driver of the other car had been drinking.”

Govier (2009:133) says that by inference, the implicit contradiction that can be drawn “… can’t have been anyone’s fault” and the statement that the “… driver of the other car had been drinking” contradict due to responsibility or a lack of it.

On the example of an explicit contradiction, there are two things to note. First, Govier uses the typical Aristotelian categories to generate the contradiction. She (2009:132) rightly comments: “As you might imagine, this sort of mistake is too obvious to occur frequently.” One might wonder then, why it is worth noting outside of contrasting with “implicit contradiction”? Second, her example uses a purported antonymic pairing of ‘tough’ and ‘vulnerable.’ An antonymic search on Synonym.com (2016a) for “tough” and on Synonym.com (2016b) for “vulnerable” reveals no pairing of these terms. While the conceptual model supports non-standard pairings, the way Govier needs these two terms to function in the Aristotelian category, is that one of them should function as negation and it is not obvious that “tough” sufficiently conflicts with “vulnerable” and vice-versa.

On the example of the implicit contradiction, it is not obvious this set of claims generates a conflict about responsibility. Just because someone was drinking does not necessitate they were incapable of driving a car safely. If someone were intoxicated, then responsibility might be an issue. To determine responsibility, in this case, one would have to ask a few questions. If the conditions were such that the person had not been drinking, would the event not have happened? It is apparent there is not enough information to make that claim, in fact, the environmental issues call into question how much alcohol consumption affected the accident.

Pedagogically, it might seem petty to point out the problem with this example and both definitions. However, students may pick out poor examples like this, and, if the example becomes the contentious issue, the students will not learn the concept. A simple qualification that the person was inebriated and that an inebriated person should not be driving, brings home the “implicit inconsistency” in Govier’s terms. The “explicit inconsistency”, as mentioned, suffers from a semantic conflict, that while conflicting, is probably not formulated in a way to contain an obvious contradiction by her own definition. It is straightforward to think about a case where someone is tough and vulnerable at the same time, both are true, so it does not suffer from being false, which can imply a contradiction in her definition. Imagine a world-class boxer who by all accounts is one of the toughest human beings in the world but is fighting in a third-world country that is known for kidnapping famous people. The boxer would be tough and vulnerable at the same time. Students might be taught that a better contrast with “vulnerable” is “protected,” so the example would make the point about “contradiction.”

Govier’s initial definitions “inconsistency” and “contradiction” are standard and demonstrate the influence of formal logical concepts on her critical reasoning (2009:146). Her move to antonymic pairing could have been exploited much stronger showing that semantic conflict is the initial judgement about inconsistency. Students need to be taught to critically reflect on examples and problems to determine if the concept is being applied properly or not. Students may dissect Govier’s “responsibility” example rather quickly because of their prior knowledge of antonymic pairings and semantic contrast and conflict.

With Govier’s definitional idea that “A single statement is also inconsistent if it entails a contradiction. Such a statement is not acceptable because we know *a priori* that it is false” (Govier 2009:146), students may be challenged to determine what all of that means? Unless a student has had a logic course, it makes little sense. Govier (2009:132) uses “There was a time before time began” as an example of inconsistent single statement that leads to the contradiction “time before time.” Students may not pick up on the false evaluation, but what they would understand is that the claim does not make much sense. But, even this “contradictory” statement could have a use at the beginning of a story for literary emphasis. More importantly, this example does not work. “Time” can be read in several ways. One way is that “time” is ambiguous, with the first meaning something like period length, and the second meaning something like sequential. Another way to read this is there was a single instance before the existence of a group. The statement does not say “There was time before time began,” which might bring across Govier’s point more effectively.

6.7.3.1 Critical reflexion on Govier

There are a few issues with Govier’s view in comparison to the SCI. The already discussed views in Moore and Parker relate to the Aristotelian and propositional concepts used by Govier, so they will not be revisited. Govier’s view of implicit contradictions is interesting because it is semantically based. It is an interesting use of the word “contradiction” due to it not being an issue of form like her use of “explicit contradiction.” Her view appears to be antonymic in principle, which is positive and shares a similarity with the SCI.

SCI, by definition from chapter four, is about harmony and agreement among claims so inconsistency would be about a lack of harmony and disagreement among claims. The first definition that Govier (2009:146) uses, “Two statements are inconsistent with each other if, putting them together, we would arrive at a contradiction.” Consider two claims: Rebecca Zahau was murdered and Rebecca Zahau was not murdered. The conjunction of these two claims is a contradiction as Govier would support. But consider the conclusions of the argument previously put forth: Rebecca Zahau was murdered and Rebecca Zahau committed suicide, is not an obvious logical contradiction. There is no explicit negation of a claim. A two-step translation move could be made where “suicide” is translated into “not murdered” but that is not a natural move outside of logical training. However, the latter claims clearly disagree and are not in harmony with particular reasons in the argument. Thus, the SCI handles an inconsistency in a straightforward manner where Govier's own definition might not even find the claims to be inconsistent.

By positing a single definition of "inconsistency" that is consistent with the overall theory, the SCI makes sense of inconsistencies and contradictions. Govier's use of "implicit contradiction" would not match her own first definition in (2009:146) as the conjunction of the claims are not explicit negations, much like the example above from Rebecca Zahau's argument. Pedagogically, this is potentially confusing to students because it is theoretically confusing – without justification – for why it is acceptable not to negate in one circumstance but having to in another. The SCI does not suffer these obvious confusions. It can be asserted that the SCI's definition of inconsistency is wrong and weak, but that is a different argument to be made by a critic. The response to that would depend on the context of the criticism, especially where a weaker definition captures in some degree what a rigid definition would posit.

Reflecting on these examples from the Rebecca Zahau case, and use of "inconsistency" by Govier and the SCI, one could object to the SCI that there is more to inconsistency than disharmony and disagreement, for example conflicting truth-values too. This could be a substantive objection if it assumed that the SCI was never concerned with truth-values. There is no problem adding truth-values, when known, after the semantic conflict is addressed and any problems with that conflict are noted. The beauty of warranted assertability is that it does not necessarily exclude the evaluation of truth-values and truth claims, instead, warranted assertability might be the best tool in context, especially when truth-values are unknown. Truth is important and fundamental, but it must be known to be operative.

Govier was correct to include conducive arguments in her text (2009:352–366). These arguments include counter considerations and the premises do not necessarily have to be linked together (2009:375). This practical approach to argument focuses on the best reasons for a conclusion all other things being held the same, which as a "best reasons" approach appears to be a form of warranted assertability (2009:375). But, one might question, why is the substantive account in chapter 12 (the last one before the appendix on fallacies)? Much of specific argument instruction in the text is spent on deductive and inductive arguments.[125] While conducive arguments are a move in the right direction, they fail to situate themselves in a question and answer context, which engages inquiry robustly. One naturally inquires with questions and answers, which the ADM exploits and positions in a straightforward argument form. It is a hard position to argue, for the critic, that questions and answers are not the basis of inquiry. If inquiry is one of the main concepts of critical reasoning, an argument model that integrates it should be considered before one that does not. Only in time will it be shown what alternative argument models will gain traction, maybe conducive arguments will along with the ADM and interrogative approach of Wright (2005:139–348).

6.7.4 General criticism of changing the subject: critical reflexions

In fairness to Moore and Parker, Govier, and Walton, the SCI can be viewed as simply changing the subject. They are nested in a tradition that is thousands of years old in part, where formal logic of various kinds, is the paradigm of rationality. The concepts of inconsistency from those traditions have upheld through the test of time and the attempt in this thesis just changes the subject with respect to rationality, argument, and inconsistency. From the dominant paradigm, that criticism is warranted.

As Kuhn argued (1970:35–47), normal science is puzzling solving. Puzzle-solving is an apt description of the current state of classical logic. There is a certain set of problems and rules that classical logicians engage and use. Those rules and problems are passed down to students. Aristotelian logic was the initial paradigm of logic and when the logic could not make sense of propositions, different connectives and their behaviour (the crisis), a new logic replaced it with propositional and quantified logic (Smith 2017). This new paradigm has existed for some one hundred plus years. While both Aristotelian and propositional logic are loosely considered classical logic, recent developments in non-classical logics are

[125] In fairness to Govier, she does include some discussion of conducive arguments in earlier chapters (2009:90–91).

challenging that paradigm with new rules and puzzles. Maybe the crisis phase is developing, but only time will tell.

The Kuhnian interpretation of the progression of logic, although simplistic, makes sense historically and conceptually. However, it is much harder to fit critical reasoning into that paradigm, especially in its modern form. From the perspective of this thesis, it is not even clear that critical reasoning has reached the normal science stage. There is not a clear set of puzzles, problems, and rules. In fact, it seems that the existing logical paradigm continues to overshadow critical reasoning. The textbooks such as Moore and Parker (2015), Govier (2009), and Walton (2006) demonstrate this lasting influence in different degrees.

If the Kuhnian interpretation of logical history is correct, it is not clear that the SCI is changing the subject. It does not have the strength of a crisis, nor are the puzzles it seeks to solve with inconsistency even acknowledged given the past reliance on the existing logical paradigm. Hamblin (1970) in one sense started a modern turn (although fallacies have been around for thousands of years [see Aristotle 1955:17–45]), but the degree to which that new direction is acknowledged is questionable to the larger paradigm of reasoning. Critical reasoning as a discipline being in its infancy is still trying to find its own traction and maybe the SCI will aid in further traction.

6.7.5 Inconsistency in critical reasoning texts: concluding thoughts

Govier, Moore and Parker, and Walton, suffer from limited conceptual clarity on inconsistency and it unfortunately informs their pedagogical practices. From my perspective, as argued in this research, critical reasoning demands a subtle approach to inconsistency providing a way for students to appreciate the conceptual fecundity surrounding contrast, conflict, and contradiction. The SCI offers an alternative for critical reasoning courses compared to alternative views that are mostly recycled ideas from the history of logic assembled in new textbooks. Whether the SCI or other semantically based views gain traction for reasoning, the history of critical reasoning will bear that out, one way or another.

6.8 A critical reasoning pedagogical usage of inconsistencies in legal systems

Studying legal codes is an effective pedagogical tool to help students understand the nature and consequence of inconsistency. The law is a natural extension of our human practices with real consequences involved. Choosing the appropriate inconsistencies helps relate the critical reasoning curriculum's material directly to the students.

In 1996, the State of California in the United States, voted on and approved Proposition 215, *The Compassionate Use Act*. California is one of the few states in the union of the United States that has direct democracy through the political processes of referendum, recall, and initiative (Ballotpedia 2017). The public can put measures on the ballot, vote and bring about sweeping changes, without being represented by an elected official as in a republic. The citizens of the State of California put Proposition 215 on the ballot and it passed.

This proposition allows marijuana use for medical reasons as prescribed by medical doctors for many afflictions including glaucoma, pain from cancer, anxiety, back pain and several ailments. Among the consequences has become that marijuana production has been turned into a cottage industry for the marijuana production industry and marijuana doctors. To get a medical recommendation for the prescription of marijuana takes about fifteen minutes in person, online or on the phone speaking with a medical doctor. It is fair to say that for some citizens of the State, the law is being used illicitly for recreational purposes and not medical purposes. The State of California Department of Public Health law states (1996):

> "(d) Section 11357, relating to the possession of marijuana, and Section 11358, relating to the cultivation of marijuana, shall not apply to a patient, or to the patient's primary caregiver, who possesses or cultivates marijuana for the personal medical purposes of the patient upon the written or oral recommendation or approval of a physician."

Where Section 11357 considers the legal enforcement penalties for marijuana possession, production and consumption, the law does not apply to those with a medical marijuana recommendation in the State of California.

However, the Federal government of the United States still criminalises all marijuana cultivation, use and possession. The White House under President Obama held the position that (2016):

> "Since 1996, 23 states and Washington, DC have passed laws allowing smoked marijuana to be used for a variety of medical conditions. It is important to recognise that these state marijuana laws do not change the fact that using marijuana continues to be a criminal offence under Federal law. Nor do these state laws change the criteria or process for FDA approval of safe and effective medications."

So, there are two issues for the Federal government, possessing marijuana is a Federal offence and the Federal Drug Administration has not approved medical marijuana for treating maladies.

With this topic, critical reasoning students recognise the legal inconsistency between the State of California and the Federal Government's legal position on marijuana use for medical reasons. Students delineate two different inconsistencies: one on possession and use, and another on medical approval. Having the students articulate the inconsistencies, the result is: it is legal to use marijuana for medical reasons in California and it is illegal to use marijuana for medical reasons in the United States of America. Since California is in the United States of America, it is both legal and illegal to use marijuana for medical reasons.

Moreover, students recognise the antonymic pair of "legal/illegal" demonstrating a strong inconsistency, although in different contexts. Additionally, students can infer that from this pair of statements – assuming the proper documentation and limited amounts of marijuana – they will not be subject to State law enforcement. However, if a Federal officer detains them, they may be subject to arrest, prosecution and fines. "Federal" and "State" are also antonymic in this context, which furthers the potential understanding of the degree of conflict.[126]

Another way inconsistencies in the law can be used is through the arbitrariness of sentencing. Consider the following information (Secret:2012):

> "In the Eastern District of New York, for example, the twenty-eight judges in the study delivered a median sentence of 24 months for drug cases in the past five years. But there were disparities: Judges Jack B. Weinstein and Kiyo A. Matsumoto gave median drug sentences of 12 months, while the median drug sentence for Judge Arthur D. Spatt was 64 months."

Supposing the drug cases are relatively similar, sentences ranged from 12 months to 64 months, with the median of 24 months. The range of sentencing is inconsistent, radically in some cases. Students also review TracReports (2012) on the same issue and compare and contrast different districts including North Texas, East Virginia, Minnesota, District of Columbia, North Illinois, and others to further ascertain if inconsistent sentencing is a local or national phenomenon. This allows them to note both internal and external consistencies and inconsistencies, giving more fodder for an informed evaluation of the sentencing issues.

Students are asked to reflect on this range of sentences and ask further questions. Is there a difference in sentencing due to age, gender and/or race? So not only may there be inconsistencies in sentencing *simpliciter*, there may be inconsistencies in sentencing based on other factors. Students are then instructed to do some research on sentencing discrepancies and bring it back to the next class session. Using a group method, students initially share and compile their information in small groups. From there, the groups merge and compile their results and eventually, the class brings forth their collective thoughts on the why there might be disparity in sentencing. This group merging technique forces students to deal with potentially inconsistent information and either resolve it or accept it, both of which take justified reasons to do so. Students are also reminded to think and look for the "special reason" defeater. Typically, students come to the conclusions that some of the arbitrariness is race based, some of it is

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[126] One way to understand the contrast between the two is on a gradation scale based on the concept of government power and their exercise of control.

just random, and still yet, some of it is warranted given the nature of the case, for example, previous offences or the amount of contraband involved. At that point, the students are further questioned about the consistency of their results, which are conflicting. Are the conflicts legitimate or not? What should be done?

The sentencing exercise exposes students to various inconsistencies, some of which are important and some are not. The dynamic nature of the issue demonstrates that the world is not black and white with respect to inconsistency and consistency. If the world is dynamic, and it seems to be so, students need to be immersed in issues that reflect our complex lives. This immersion puts critical reasoning at the forefront of understanding the importance of the issues(s) involved. It also teaches cooperation, listening skills, and a pragmatic attitude toward results. These skills all transfer to everyday life, employment, and even personal relationships. Reasoning is part of life and should be taught as such.

6.9 Concluding thoughts

Students need to be taught to rely on the natural language skills and trusting their intuitions about semantic conflict. In Govier's presented example of "vulnerable" and "tough," students may perceive the conflict and that should raise suspicions. Where they do not see the semantic conflict, students should be encouraged to read, and read more. Semantic conflict is difficult to understand in isolation. The more examples and in different contexts, the more likely someone will be able to recognise when a semantic inconsistency is important and when it is not.

A natural means to achieve linguistic competency is through reading and improving one's vocabulary. One way to encourage this is to have students keep a notebook of "new" words for them, and their definitions. By reading various materials that includes semantic conflict, students come to see patterns of the use of words. These patterns may pair up two words, in contrast, that the student does not know. They may not be canonical antonyms, nevertheless the context dictates they are conflicting. By reading diverse types of materials students benefit to this end. So, students should be encouraged to read as much as possible to improve linguistic competency, which includes semantically conflicting words not in the standard antonym canon.

Chapter 7: Conclusions and implications

The final research question is now considered: *what is the best concept of inconsistency for critical reasoning and pedagogy?* To answer this question, three aims were posited. In this chapter, and considering the material from the previous chapters, these aims will be discussed and the implications will be developed along with critical reflexions.

7.1 First aim: to correct the identified flawed conception showing that critical reasoning in theory and practice is distinct from formal propositional deductive logic as an implicative system of rules, and critical reflexions on the first aim

In chapter one, a historical tour of the history of philosophy revealed different conceptions of "inconsistency."[127] The consequence of these differing conceptions suggests that inconsistency is not a univocal concept. These many concepts set the context of the research question. In chapter two, a system of propositional logic was put forth along with the explosive conception of inconsistency.[128] This conception manifests due to the implicative concepts of ECQ—from a contradiction, anything follows, and EFQ—from the false, anything follows. More so, the syntactic type of contradiction, with the form $(P \cdot \sim P)$, is the modern paradigmatic form of inconsistency. In chapter three, the system of propositional logic was critiqued from various angles including articulating translation problems, a lack of correspondence between connective meaning and natural language meaning, and problems with the explosive conception of inconsistency.[129] Those issues helped to demonstrate the overall problem where the implicative patterns of propositional logic are (mis)understood as principles of

[127] In terms of the objectives of the thesis, Objective 1: to provide a limited relevant history of inconsistency.
[128] In terms of the objectives of the thesis, Objective 2: to accurately represent propositional logic.
[129] In terms of the objectives of the thesis, Objective 3: to accurately critique propositional logic as a system.

inference, especially ECQ. EFQ implicates as well through the logical assumption that anything follows from the false, and a contradiction is necessarily false on all rows by its truth table. Finally, in chapter five, the results of the previous chapters and additional information were used to critique the use of propositional logic in critical reasoning courses.[130]

The intent of chapters two, three, and five was to set the conceptual foundations for divorcing specific logical contexts from normative ordinary reasoning practices. Those logical contexts are implicative, not inferential. An obvious objection challenges that what we do in practice is not what we "should" do in practice (Shapiro 2013). For that group, classical logic should be used as it eliminates vagueness and ambiguity, and gives a formal structure to reasoning (Shapiro 2013). In fairness, from the perspective of a classical logician, those merits may be true in the proper context. As they see it, adopting a translation project may make the natural language relations clearer by taking it from its original context, symbolising it, and clarifying the implication through rule use. For them, the unclear aspects of natural language have become clearer in the ways mentioned. I, however, have argued that it is not clearer as translation misses crucial elements that aid understanding including context and semantic relations. More so, the implicative patterns may or may not mirror what we do when we naturally reason. But if my criticism is right, implication has been confused for inference, derivation for argument, and our natural reasoning practices, by their very nature, are inferential.

One point at stake here is a judgement call about what is more important in natural reasoning: inference or implication. Inference is the substance of our natural reasoning practices; implication is not. The classical logician wants to replace in part, or in total, inference with implication.[131] I have made a sustained argument that inference is more important that implication, especially in the context of critical reasoning. Nowhere have I argued that implication is not

[130] In terms of the objectives of the thesis, Objective 5: to critique propositional logic as a system of critical reasoning.
[131] Shapiro (2013) in his discussion of various views implies this is true of philosophers like Quine and Frege. Neither is going to explicitly state they prefer implication because that is not a term they used. Their use of the formal apparatus demonstrates this and their preference for it.

important *simpliciter*, as it has fundamental applications in mathematical logic and mathematics in general. As well, I am biased toward inference for critical reasoning because it comports with human experience. Is this bias warranted? If the function of a critical reasoning course is to articulate and evaluate our natural reasoning practices that manifest in our everyday experience, then the bias may be warranted.

This tension between inference and implication, and preferring one over the other, leads to an epistemic choice: a presuppositional choice. There are some alternatives: inference over implication; implication over inference; and, choosing both for specific contexts. The argument here is that for critical reasoning, inference should be chosen over implication. Others such as Wallis (2017) and Poston (2012) chose both for critical reasoning, which seems to be relatively common during the syllabi review. But, the issue is, what justifies that choice and why?

It is difficult to find a definitive answer for settling the epistemic dispute other than the arguments provided in chapters four, five and six. One would have to believe that propositional logic adequately expresses our normal reasoning practices and/or should represent it. One would also have to believe that translation problems are not as problematic as argued in chapter three. In particular, someone would believe that the translation problems do not undermine their practical effectiveness. Finally, one would have to make sense of the gradations, contrast, and semantic relevance among natural language ideas through propositional language as demonstrated in chapter four, if they believe the language needs to comport in the same or very similar way. In my estimation, an acceptable handling of these problems would be extremely difficult as reducing a complex system of ideas to a simple system of ideas will undoubtedly leave something out that is relevant. These logicians leave out what I think is important and vice-versa.

Linked closely with implication is the notion of certainty. One can understand a preference for implication over inference, due to the result it provides epistemically. In an ideal world, implication would reveal necessary relationships between claims demonstrating certainty. This is an admirable goal for any type of reasoning and maybe should be our goal. But we are left with the old “is” versus “ought” tension between our practices and our ideals.

Presuppositions are deeply held commitments and holding presuppositions explains the divide between inference and implication. Explanations come to an end someplace, to paraphrase Wittgenstein (1973:§1), and it may be that deep disagreement – as Fogelin (1985:5) mentioned – is at the heart of not being able to determine which one is correct. As a student of reasoning, when competing presuppositions hold, reason can be impotent due to the emotional commitment to the presupposition. Thus, an impasse may result.

7.2 Second aim: to develop and articulate a natural language account of semantic inconsistency that captures what we do in practice with inconsistency judgements in everyday reasoning, and critical reflexions on the second aim

Inconsistency should not be that controversial of a topic in most instances. In everyday life, inconsistencies are noted rather quickly in obvious situations. A recent murder case in Orange County, California, U.S.A., has inconsistencies in the testimony of a suspect that eventually led to his arrest (Puente & Saavedra 2018). A few to note: the suspect said he went to his girlfriend’s house but could not remember her address; the suspect had a girlfriend but did not know her last name; and the suspect was an Eagle Scout but is now charged with murder (Puente & Saavedra 2018). On an ordinary understanding of the claims being made, they are inconsistent: to drive to his girlfriend’s house he should know the address—and does not; he has a girlfriend and should know her last name—and does not; and finally, the character of an Eagle Scout is exemplary, which is not the same as a murderer’s character.[132] This judgement for competent language users on the first two inconsistencies is immediate, based on semantic conflict.

[132] An Eagle Scout is the highest rank that can be achieved in the Boy Scouts of America. Only 4% of all Boy Scouts earn the title. An Eagle Scout earns the honour through a number of competencies manifesting in a public service project (https://en.wikipedia.org/wiki/Eagle_Scout_(Boy_Scouts_of_America)).

The last one, however, is more complicated: the conceptual antonymic contrast between an Eagle Scout and a murderer. These are not mutually exclusive categories; however, they conflict in a way that shows the tension the authors wanted. The authors' intent also shows these inconsistencies are substantive to assessing the suspect's guilt. It is my position that the account of semantic inconsistency presented in this thesis, handles all three instances of these inconsistencies *prima facie*; whereas, the propositional account – based on form alone or truth-values alone – does not, especially the last inconsistency.

One of the more critical aspects of my account of inconsistency demands that the semantics of a claim take priority over the truth-values of a claim. The Orange County murder instance further typifies this because we do not know if these claims are true or false. We were not there when they were told to law enforcement; and we do not know the motivation of the suspect (e.g. maybe he is covering for another friend who is guilty). But we do know that based on semantic meaning these claims conflict and in the context of a murder investigation may be cause for alarm and further inquiry. Thus, even without knowing the truth-values, we know the inconsistency points to a problem with the suspect's testimony.

The critic may respond that I have made an obvious point in the ordering of understanding. Semantic conflict leads to truth-value assessment. But the concern is not the conflict but determining the truth-values–after all, is that not what matters in testimony? I think inconsistency is a special case, not like normal claims where the truth is easier to determine because of the lack of conflict. In cases of inconsistent claims, much like the sceptics, there may be good reasons to believe the claims are both true and false. So semantic conflict can and should lead to truth-value assessment but the world is not that easily satisfied, which is one reason for the use of warranted assertability.

The general aim is not obviously controversial; in fact, some may see it is as apparent. But philosophers and logicians like Quine and Frege (Shapiro 2013) may believe that I have not gone far enough. So, if natural language is inconsistent, what is the problem? From their perspective natural language can be improved upon by taking on some formal principles of symbol manipulation and implication rules leading to a unique logical outcome. By embracing these results, the problem with inconsistency is clear: it leads to a result that anything follows from a contradiction. Consider the three inconsistencies in the suspect's story. If we formalise them (or just one of them), the logical implication is that anything follows from them—which implies the suspect's testimony has no value. This is the logical implication of form and implication rules (ECQ), or truth-values (EFQ), whichever one is prioritised.

Should we not trust anything the suspect says? Of course not. One problem with ECQ and EFQ in this case, is that they *prove too much*. If the suspect confessed to the murder, would we *prima facie* reject that, too? The implication from the logical critics is that we should. However, none of us would do that without sufficient reason and context to warrant it. My theory of semantic inconsistency does not "over" prove anything. What it displays is that there is a conflict; in this case, three conflicts, which, in the context of a murder investigation, are telling. The context situates the importance and value of the inconsistencies.[133]

The account of semantic inconsistency in this thesis is not without flaws. It relies on two fundamental notions: the general understanding of the way the world works and competency with a language. If either of those is lacking, discovering the inconsistency may be difficult or foreign to the person attempting to make the judgement. I purposely chose the murder story because it sets up this objection. If one does not know what an "Eagle Scout" is – and many unfamiliar with this American entity will not – the contrast, to decide the inconsistency, is lost. To counter this, reading the article in a charitable manner from the author's perspective, displays some implied contrast in the *syntax* of the sentence. Without knowing the meaning of the words, the contrast is still there, albeit austere. This contrast is unusual because the reader does not know the contextual meaning of two of the words (i.e. "Eagle Scout"), but knows the other ("murderer")—and yet still recognises there is some form of semantic conflict (inconsistency) between

[133] Imagine the same murder account, but in fictional terms, here the conflicts do not mean the same thing in terms of practical effect and importance, e.g. there will be no further investigation into the murder.

them. It may be that in unusual cases like this, there is a syntax and semantic conflation, which may undermine my semantic basis for inconsistency in some cases.

With the semantic and syntax conflation as a potential counterexample, does it undermine the semantic theory of inconsistency? No. Counterexamples function in several ways and in this instance, it demonstrates that the semantic theory is incomplete. However, counterexamples can be taken as devastating to a theory much like the property of explosiveness – one counterexample destroys a theory. To avoid this, the relative scope and frequency of the counterexample needs to be considered. In the austere case mentioned, the semantics still aid in the explanation even if the syntactic structure contributes as well. More so, the fact that the semantic theory makes sense of the three inconsistencies in the Orange County story shows it is a better theory than the theory of inconsistency from propositional logic that only makes sense of two of them, counterexample withstanding.

The greater context of the general understanding of the way the world works is a necessary part of the way my account of semantic inconsistency functions. A semantic inconsistency can be obvious or not, depending on the linguistic capability of the person involved. Some may find this type of inconsistency difficult due to a lack of conceptual understanding and language skills. An austere account of inconsistency such as that offered by propositional logic, may be the straightforward way to initially understand inconsistency due to simplifying the concepts to syntactic contrast. While I have been hard on propositional logic and its concepts of inconsistency, the context will settle if it is the best way to understand inconsistency for those with a lack of general understanding of the way the world works and linguistic competency. Once the logical notion of inconsistency is understood, the semantic type can be introduced as direct canonical antonyms displaying the obvious contrast (e.g. black/white), and then as the skill develops, non-canonical ones introduced (e.g. murder/suicide).

In chapter four, the semantic theory of inconsistency related to the analytical defeasible model of argument (ADM).[134] This model of argument uses semantic inconsistency in the reasons and conclusions, where conclusions are inconsistent with one another, and reasons may be specific to one conclusion but not to another. In the context of inquiry and asking questions, answers/conclusions are sought to close the inquiry or illustrate that more inquiry might be needed. This model was further detailed with a second direction, in inference to best explanation arguments and articulations. This novel approach from Wright (2001:Ch.5) has conclusions explaining some of the reasons.

I attempted explaining how the analytical defeasible model of argument aligns with our natural reasoning practices through questions and answers and looking for reasons to support one answer over another. The Zahau case was used to illustrate this model. One criticism of this model might be that there are two main arguments and they should be schematised individually for clarity purposes with each set of reasons and their specific conclusion. More so, as individual arguments, whole arguments can be judged side by side to easily see the similarities and differences. For clarity's sake that may be true and I offer no substantial rebuttal other than to say the relevance articulations sort out the top ranked conclusion (when the reasons support a single conclusion). The final ranking is clearer with a top ranked conclusion than with two arguments with two conclusions and no mechanism to judge which conclusion is most supported. The analytical defeasible model is goal based; the clarity concern does not offer a way to reach the goal, which is already built into the mechanism of the analytical defeasible model of argument (ADM).

Chapter six developed the concepts of IRINCON (irrational inconsistency), RATINCON (rational inconsistency), and SINCON (single conclusion) to cover the conceptual landscape of inconsistency within the ADM. The ideal is SINCON where the reasons support a single conclusion as the answer to the context question. However, when reasons do not clearly support a single conclusion but

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[134] In terms of the objectives of the thesis, Objective 4: to use a contemporary antonym theory to make sense of semantic inconsistency judgements in ordinary language and arguments.

offer a rational basis for two conclusions, RATINCON is used. Finally, when there is no rational basis for two conclusions (or more) the argument is intractable and irrational, or IRINCON.

It is important to grant that all three concepts work with the model of argument and are linked to it. Thus, using them outside of the ADM is not their intent. Of the three concepts, RATINCON is most interesting because it concedes that a semantic inconsistency is rational and still allows action. There is no halting effect to the inconsistency. More inquiry may be needed for resolution, if the context warrants it.

However, one may argue against the very idea of a “rational inconsistency.” Inconsistencies, on this critical view, are irrational by their nature. They should not be accepted. More so, had the arguments been separated for clarity’s sake, there would be no inconsistency in the argument but inconsistency between two arguments. Choose the best argument of the two, and the inconsistency is gone according to the critic. So, in effect, the ADM model *produces* the idea of a rational inconsistency given, the same ranking of two conclusions.

One problem with that criticism is that it is shortsighted and practically inadequate. It assumes that one will make the best choice between two (or more) arguments with no mechanism for that, other than personal preference. Resolving the inconsistency by separating arguments does not resolve the inconsistency; it only puts it into a different form that undermines taking it as seriously as it should be as a sum of all the reasons and conclusions. Applying relevance articulations gives a mechanism based on the relevance between a reason and conclusion(s) to determine what conclusion has the most support in contrast to the other conclusions.

Another criticism of my view is that inconsistencies should not be schematised at all. The job of the person offering the argument is to resolve the inconsistency before, so that the argument is consistent from the outset. Let us consider that seriously. What mechanism and process does one adopt to do that? What are the standards for which one claim is dropped and another is not? These are fundamental questions that must be answered if we are going to teach our students how to do it and why. More so, suppose that one does resolve the inconsistency in this manner, what does it say about the inconsistency? If the inconsistency can be solved before, it is not obvious the inconsistency was substantive at all or it was an *ad hoc* move based on personal preference and not some objective standard. Substantive inconsistencies are not so easily resolved.

The other part of the criticism is more substantive about inconsistencies being rational. I believe that a categorical acceptance of inconsistencies being irrational is deeply flawed. If one holds this position (and I am not sure anyone does), quantum mechanics, naïve set theory, and even natural language with self-referring predicates, are irrational. The critic must explain why their irrationality is problematic. The concern then becomes sorting out which inconsistencies are rational or irrational. It is in that spirit that the thoughts of this thesis were written and hopefully they have advanced that discussion toward sorting them out when needed.

Theoretically, however, Cherniak (1981:161–183) sets some minimal consistency and minimal rationality conditions *per* previous chapters. We should seek to resolve inconsistencies where we can, and where we cannot, we need to adopt rational measures that will still allow action. The concept of RATINCON was developed with this in mind. The relationship between an inconsistency and paralysing action is not a necessary one, which is part of the conception that needs to be corrected.

7.3 Third aim: to provide a novel account of how to handle semantic inconsistencies for pedagogical application in critical reasoning courses and, critical reflexions on the third aim

Pedagogical considerations are serious matters. Unlike the previous aims, this one affects students and their future. As educators we believe that what we teach students is valuable. The value can vary depending on the subject, sometimes it is theoretical, at others it is practical, and still, yet others, both. I would hope my account fits both theoretical coherence and practical concerns. As this view arose in part from my own practical experiences as both a student and a teacher, it may have unduly influenced me in the practical direction. This bias, I believe, is well-founded. The concepts of natural language are sufficient to detail our reasoning practices. If one believes that another means must be used to detail our reasoning practices, it seems to me the burden is on them to demonstrate a better way to do it. I have contended for multiple reasons that propositional logic is not a better way, so a critic will have to look elsewhere for an improvement. Until that has been sufficiently articulated and demonstrated to capture our reasoning practices as robustly as natural language and human practice, a natural language account of reasoning practices is likely the best candidate.

I have strong views of how critical reasoning should be taught, which have motivated this thesis. Foundational to my view is that propositional logic has little value to critical reasoning and it has unnecessarily influenced how inconsistencies are thought of and handled. Pedagogically introducing propositional logic into critical reasoning courses creates a split course where natural language and formal language are taught. I have argued extensively that formal language use should be minimised in a critical reasoning course as it distracts and undermines the conceptual emphasis on natural language understanding and reasoning practices.

An educator who believes that critical reasoning should involve propositional logic likely believes that formalism, implication, and translation provide value issuing in clarity and precision. Without a doubt, propositional logic is clear and precise in the context of a formal language. But, what substantial commonality does a formal language have with natural language? These two languages are two different articulations of relations. A formal language can articulate general relations, but has difficulty with subtle relations like gradation, which natural language handles effectively.

I also challenge the claim that natural language is not precise. In fact, the number of concepts in natural language is far greater than a formal language. Natural language can thus be clearer and more precise through careful delineation. One must acquire the vocabulary and use it effectively. If educators focused on vocabulary improvement, especially about reasoning, student clarity and precision may improve in the right context. The result would be better reasoning through semantically specific premises and conclusions.

In chapter six I criticised the views of Moore and Parker, Walton, and Govier. I found their accounts of inconsistency lacking. Part of that criticism stems from their more or less traditional thoughts on inconsistency being truth-value based. To counter this in some detail, I adopted the notion of warranted assertability. Fundamental to my position is that critical reasoning does not have to rely on truth-values for intelligibility or assessment. In many arguments, the Zahau case for instance, or the Orange County murder inconsistency, the truth of claims is unknown and/or unsettled. When warranted assertability is applied to these claims, the best reasons stand as the evaluation tool. We should believe the best reasons until we have reason to believe otherwise.

As mentioned in chapter one, philosophers were focused on truth whereas Sophists were concerned with persuasion. One criticism of warranted assertability is that it denies the fundamental philosophical enterprise: truth seeking. More so, the best reasons still could be false, so the qualifying “best” is weak. If we are to take critical reasoning seriously, for the critic, truth must be at the heart of our practices including not accepting inconsistent conclusions and/or reasons in an argument and knowing the truth of reasons in an argument.

Although the focus of warranted assertability is not truth *per se,* it is not inconsistent with it. The best reasons can be replaced with true reasons if they are known to be true. Truth is still sought, but practically for many arguments the truth of the premises is unknown. I do not think we give up reasoning due to not knowing truth-values and my account allows for when truth-values are unknown. I think, however, there may be a deeper objection by philosophical purists, namely that the disregard for truth is more consistent with persuasion and Sophistry than philosophy. That is a fair objection as it demonstrates that the spirit of my view has been understood. The wedding of truth, logic, and argument, sets up a particular picture that alternative views are not philosophical or as philosophical. Maybe so, but critical reasoning is not an entirely pure philosophical discipline, given its practical nature, linguistic basis, and emphasis on communicative measures. It seems to me that if this criticism is substantive, then mathematical logic would hold non-philosophical consequences as well, and would not be part of the purist's view either.

One area that I touched on dealt with the education of critical reasoning teachers and some of its flaws. Knowing I have strong views on this, I have tried to be charitable. Part of my weakness, however, is that much of my view is anecdotal having taught for eighteen years on six campuses in two distinct geographical locations. I have been exposed to other teachers of critical reasoning who had different educational and social backgrounds. I have witnessed the rampant use of propositional logic in critical reasoning courses where it varied in application. Reviewing the syllabi mentioned in earlier chapters demonstrated an obvious pattern of many critical reasoning courses: some form of propositional logic, fallacies, some linguistic applications like ambiguity and vagueness, and some form of inductive logic. This pattern repeats itself in the textbooks reviewed as well.

The industry of critical reasoning supports the problem that I have struggled against in this thesis. Whether the textbook brings about the curriculum or the curriculum brings about the textbook, the problem is the unreflective nature of both.[135] This is further compounded by schools who choose the textbook for the instructor based on their course objectives/content curriculum paperwork.[136] I think part of the problem is that introduction to logic books typically share the same content but in different presentations. There is some uniformity to them conceptually. Critical reasoning textbooks, based on the logic textbook model, then have a similar uniformity. But, we should all be reflective of the material for our courses and not be constrained by textbook choices. Textbook authors choose material they believe is important and that can be in error. Current

[135] As a former Curriculum Chair at my current school, it (was) is common for new courses to be based on the table of contents of textbooks. For some courses, it was a one-to-one correspondence.

[136] I once applied for a part time lecturer position at Victor Valley College, Victorville, California, U.S.A. They informed me that I had to use their textbook of choice and follow their general syllabus as well, which included propositional logic in a critical thinking course. I never taught there due to this lack of choice.

concerns about diversity in the curriculum are largely the result of a suppressive source choice or the “canon” in most disciplines. Why is Sartre more important in existentialism than De Beauvoir? Why is a two-valued logic more important than a Buddhist four-valued logic? Why is Westernised linear thinking prized over Native American circular thinking (Rose 2014)? The simple answer is that the former are all part of the canon, which is resistant to change. Textbooks reinforce that canon purposely or unwittingly, but the result is the same.

My challenge by means of this thesis is to critical reasoning educators. I want them to critically reflect on what they teach and why. Is the material choice because of what they were taught in graduate school? Is it what the textbook dictates? Is the material choice what the educator knows best and teaches to their strengths? Is the lack of reflexion because they have become intellectually lethargic? There are multiple reasons for this lack of cogitation. But as a model of critical reasoning, educators should employ critical reasoning to their own pedagogy and see if it meets the muster of what is best for their students. While my approach may not meet the muster for all, it is an attempt to do something valuable for students, to improve their critical reasoning skills and the ability to articulate the importance of reasoning in everyday life.

7.4 Future considerations

While writing this thesis, additional questions arose that follow from the ideas put forth. There are two types of future considerations: negative and positive. The negative considerations relate to where the thesis fell short and needed areas of future research. The positive considerations are potential future extensions of the research. Each will be taken in turn.

7.4.1 Negative considerations

There are at least three areas where the thesis is lacking: a critical analysis of the conceptual antonym theory; a consideration of other methods of informal reasoning for use with the theory of semantic inconsistency; and, an analysis of critical reasoning as a discipline–and if it is needed at all. I will start with the latter and move to the former.

Given the recent history of critical reasoning and the informal logic movement, one could argue that formal logic and its use has been established as the paradigm. A thesis on semantic inconsistency is undermined by the history of philosophy given its reliance of Aristotelian, Stoic, and contemporary logic. Translation is part of the philosophical practice going back at least to Aristotle, where statement types were the form and content was instantiated into the forms. Arguments that met the logical form were valid and those that did not, were not valid (see the *Posterior Analytics* [1941:110–187]). Aristotle also wrote on persuasion and ordinary reasoning extensively in the *Rhetoric* (1941:1325–1454). As mentioned before, this content pattern fits the basic textbook and pedagogy of some current critical reasoning courses that include both a formal and informal component. The modern critical reasoning movement is just reinventing the proverbial wheel, as Aristotle articulated in detailed substantive conceptions of both components.

More so, psychology, English, speech, and communication courses cover this informal component through coursework and textbooks. Critical reasoning courses are not needed as they overlap extensively with these other areas. Hence, in my rejection of propositional logic as useful in reasoning, the result is admitting that I have changed the subject. The material from my book, and other critical reasoning texts could easily be incorporated into a critical writing course, for instance. If this is all correct, why should critical reasoning be a specific discipline and have its own courses?

I believe there is a negative argument and a positive argument for critical reasoning as a discipline. The negative argument posits that the movement would not have gotten traction had it not been relevant and needed. The fact that it exists, demonstrates that some philosophical need was not being met by the logical and reasoning teachings of the day. I also think that if someone holds the position that critical reasoning is not needed as a discipline, the same person needs to explain why non-standard logics were developed and are now in use.

Innovation leads to new disciplines. The positive argument for critical reasoning is that it is an active research area and fills a specific role in general education curricula. More time can be spent specifically on reasoning related concepts than in courses where critical reasoning is part of the course but not the topic of the course. To justify this, however, is another area of weakness. No studies have been done that I can find that demonstrate that student reasoning has improved since the mid-1970’s when the critical reasoning movement started coming to fruition. Ultimately, if a study were done, I conjecture that critical reasoning as a discipline may be justified by success rates, demonstrating improvement in practical reasoning, in critical reasoning courses, over and above that same reasoning in introduction to logic courses.

Not considering other methods of informal reasoning is the second negative consideration. One of the most prominent methods is the use of argument diagramming. Groarke and Tindale (2013:108–166) and Van den Berg (2010:57–71) use the method of argument diagramming to show the relationships between reasons and a conclusion. The practice goes back to Beardsley (1950) and reached popularity through the widespread reasoning texts of Toulmin (1958) and later through Scriven (1976). Argument diagramming, thus has a history of expressing inferential and implicative relations.

One positive of argument diagramming is that it provides a visual diagram of relations that may aid in understanding. This is especially helpful when a source has multiple independent reasons that are not congruous in a text or other media source. More so, when arguments have dependent nested, or sub arguments supporting a main argument, diagramming may help expose these complicated relations. Diagramming arguments has some use where a visual representation of complicated relations is needed.

Another positive of argument diagramming is that it does not have to use the formal concepts of deductive validity and soundness. The diagram can demonstrate inferential relationships without supposing implicative relationships. This fits well with critical reasoning courses, but it is also a skill that could be carried over to introduction to logic courses. In this latter case, the method could be used in both courses, which would make it a wise pedagogical choice if one were having to teach both courses. Both implication and inference could be demonstrated with argument diagramming showing its effectiveness to reasoning on a whole.

Argument diagramming could be modified to handle inconsistencies relatively easily. Instead of using just circles for reasons, a different shape could be used showing the two reasons that have inconsistent content. As well, the diagram could be modified to display competing conclusions and related reasons to those particular conclusions. Finally, one could introduce a context question as a distinct box that would show the relationship between the question and the competing conclusions. Thus, the argument diagramming approach is not necessarily inconsistent with the ADM.[137]

Pedagogically, however, argument diagramming may introduce another level of complexity and translation. Students are required to learn a new set of symbols and the process of representing relationships accurately. It is a type of reductive formalism and translation. The semantic content is set aside to analyse relations, which seems to undermine the very reason to do it. You must understand the semantic relations to diagram correctly, so it may be redundant. Semantic relations should be a priority in critical reasoning courses, as those relations come before any truth-value determination and assessment.

As this thesis used a single antonym theory and only briefly mentioned another, an objection looms over that choice and use. The canonical model of antonym theory (lexical-categorical theory) based on opposition in the corpus is dominant. This theory is somewhat static and involves word pairs that semantically conflict, such as black/white, dead/alive, and true/false. While there is little doubt that word pairs function in this way, the conceptual model articulates additional ways based on context, such as murder/suicide. The worry with the conceptual model is that it pairs words that are not pairs, and the process become

[137] Thomas (1997) does something similar in Chs. 1-4 showing how among other things, reasons counting for or against a specific conclusion by adopting a dotted line instead of a solid one for the “against” aspect.

arbitrary. The canonical model does not have this same sense of arbitrariness due to historical contrasting word use and exceptions through indirect antonym conflict.

This thesis did not consider in detail the psycholinguistic research on antonymy. There is research that demonstrates that direct canonical antonyms are more easily recalled and semantically prime contrast more than the conceptual model where indirect antonyms have the additional element of context (Jones, Murphy, Paradis & Willners 2012:13–14). This positions the conceptual model to be weaker in application and may indicate problems for recognising semantic conflict, especially with limited time to make judgements.

Since the conceptual model is embedded in a theory of reasoning (the ADM), there may be further complications. While direct canonical antonyms do not rely on a specific context, the indirect antonyms in the conceptual model do. There is indirect contrast that must be acknowledged and that contrast is a part of inference to a conclusion(s) in an argument. The implication is that processing times may be even slower and affect the use of the argument model negatively.

The research that would have to be done to justify the argument model combined with the conceptual model would have to include total processing times for argument schematisation. This research would also have to evaluate the contrast to argument schematisation in other models including those that require translation and then the schematisation. If it could be shown that, for instance, propositional logic or argument diagramming were able to schematise the contrast and improve processing times, there is a scientific basis for rejecting the ADM. Contrastively, were the ADM more efficient and had that research been done, there would be a scientific basis for its choice as a theory of reasoning. Until more research is done, the effect of argument models on processing speeds will be unknown.

7.4.2 Positive considerations

There are five significant areas of future research that may be worthwhile to pursue: simplifying a paraconsistent logic for formalism purposes, contextual analysis for conceptual antonym pairs, empirical translation studies, the development of better ways to teach reasoning about inconsistencies through real-world examples, and the application of the theory to assessing inconsistent testimony and evidence in the legal system.

Paraconsistent logic is a formalisation of an inconsistency tolerant logic as detailed in chapter one. It might be prudent to try to devise a system of paraconsistent logic that is minimal and is able to handle inconsistencies in a straightforward manner. By moving in this direction, an alternative is constructed for those who want to reason formally with inconsistencies, something not offered by this thesis. If this logic could be achieved where one desires, maybe the incorporation of paraconsistent logic could replace classical propositional logic in critical reasoning textbooks that want some kind of formal approach. One benefit of this is that ECQ is not taught and students do not learn the explosiveness property of a contradiction. Another benefit is that students do not poison the well against inconsistency unnecessarily. This psychological aspect encourages students to seek out substantive inconsistencies and set aside those that lack substance. The weakness of this, however, is that adopting this paraconsistent version still would not solve the translation issues. Thus, its value might be limited but still in the right direction.

Another area of interest that might be fruitful is analysing the contexts of antonymic patterns to understand how non-canonical or indirect conceptual antonyms contrast. The inconsistent claim of an Eagle Scout accused of murder is one of value, where someone has a notable character that is violated by a heinous act. Using the conceptual antonym theory, especially the notion of gradation, where does the contrast begin and end in this kind of case? If it were merely theft would the contrast still hold? Also, gradation itself is subject to vagueness claims. Does vagueness undermine the necessary contrast for a pair to be antonymic in one context but not another? These are important questions because the desire for a semantic theory of inconsistency should be as comprehensive as it can be, so making sense of as many examples as possible. This thesis does not explore these ideas in sufficient detail, as it is a preliminary work. The concept of "gradation" alone could be the subject of doctoral thesis. This thesis gestures toward its importance for future research.

In chapters three, five and six, translation concerns were articulated. One area, in particular, was found to be completely deficient in research: logical translation for primary and second-language learners. This thesis opens a whole area for empirical research on the similarities and differences for primary and second-language learners, and their respective issues for logical translation success. Anecdotal evidence was substituted for devised studies, which are likely much more the domain of a linguistics' thesis than a philosophy thesis. Nevertheless, valuable information could be gained by carefully formulated studies that may or may not support the translation project.

Imagine it was demonstrated that second-language learners have more conceptual problems with translation than primary language learners. This would require a rethinking of the curricula for logic and mathematics courses. Imagine, as well, that primary language learners are at a disadvantage for translation exercises due to only being skilled in one language. This would also require a rethinking of the curricula for logic and mathematics courses, where translation is an integral part of both subjects. But I do not think it stops there, as a larger issue looms.

Considered cross culturally as an example, Native American students, may have different epistemological commitments. As Hester and Cheney (2001:324) write:

> "Ceremonial worlds place communication and reciprocity with natural environments—rather than the desire to dominate those environments or to establish 'truth claims' about them—at the very heart of the production of knowledge and wisdom. Ethical maturity rather than true belief is the goal."

Particular to Native Americans versus the dominant American culture is the notion of *reciprocity.* Finding out the “truth” of the environment is not a goal, nor is manipulating the environment. Instead, living with the environment requires an ethical commitment to not see it as distinct, but as something compatible with humanity. As the quote reveals, truth is not the goal.

Imagine a student with those beliefs being taught that natural language aligns with formal language, and truth is obtained when they align or correspond. If the student were confused, it would understandable. The approach of this thesis, using natural language and warranted assertability, would allow the student to remain within their own paradigm of understanding yet reasoning effectively. So, the consequence of exploring primary versus second-language users and their translation problems is also highlighted by potential world view problems that would have to be accounted for with any study. I fear that delineating the concepts accordingly to set up a study may be next to impossible due to the number of cultures that may have language and worldviews that are not strictly or loosely compatible with propositional logic.

Another area of interest involves a reorientation of critical reasoning pedagogy by teaching from examples to theory. Given my interest in sustaining reasoning in ordinary contexts, real-world examples set the stage for a theory to be implemented. This approach is intuitive, as the example provides the grounding for understanding the theory. The ADM is natural, in the sense that it is based on questions and answers. With the right real-world examples, the reasoning is already present but it needs to be articulated though schematisation. The hope of this extension is for students to see enough examples where reasoning exists, that when they come across new examples, the reasoning pattern comports from the previous examples used and can be applied much easier. I have done some of this in my courses already and for the students it is more intuitive than taking a theoretical concept and hoping they can map it on to the real-world example. The bigger project is teaching theory through examples. Philosophy can be difficult, given its abstractness, and this pedagogical technique might be very useful to aid student understanding.

The final area of interest is the potential application of the theory of semantic inconsistency to legal reasoning in assessing testimony and evidence. In the field of law, the concept of “reasonable doubt” is at the forefront. The degree to which this is completely understood is questionable by juries and even scholars due to a lack of clear definition (Dlamini 1998). Semantic and logical inconsistencies arise in testimony, which may or may not affect the application of the reasonable doubt criteria. This problem is further muddled when considering the application from the attorneys’ perspectives or from the perspective of the jurors. An attorney may consider the inconsistency something that undermines reasonable doubt, yet the jury does not. And the opposite is as likely, depending on the complexity of the testimony and evidence. Part of this is a lack of understanding of the concept of reasonable doubt but the other rests on understanding, if the inconsistency is substantive or not. One area that might be fruitful in solving semantic inconsistencies, in this sense, is the use of prior and posterior probability judgements, where the degree of understanding affects the acceptance of the inconsistency or not. To do this, however, would require a contextual change for the ADM to setting probable conditions as a structural guide and a reliance on specific understanding of the context. What this may imply is that juries may need to be educated in more complex matters if they are to make the correct judgement about reasonable doubt, and its relation to testimonial and evidentiary inconsistencies.

7.5 Final thoughts

Semantic inconsistency is an exciting topic that has many facets. In this thesis some of those were presented. Inconsistency in general is interesting because it not only guides thought, it guides behaviour as well. In some instances, inconsistency of any type is clear and straightforward. It can be determined rather easily. In other instances, inconsistency is not so clear and needs further articulation to assess its significance. This thesis is an attempt to provide that articulation and assessment. While I have no doubt that it may fall short in some areas, I believe it is in the right direction to give attention to when inconsistencies matter and when they do not. Thus, returning to the research question set out at the beginning of this thesis, I have argued that the best concept of inconsistency for critical reasoning theory and pedagogy is the semantic one, as the other schemes fall short in numerous ways.

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